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III. — LIVE STOCK AND BREEDING.

a) GENERAL.

b) SPECIAL.

set up a saw-mill which sawed one thousand feet, board measure, a day. Even here, however, the leasing system was the basis.

The underlying theory that the farmer would soon push back the lumberman from his present limits into the unexplored hinterland is the probable reason for the indefinite character of these leases in regard to termination. In the first instance they were all yearly leases and to-day the great majority retain this form. In Nova Scotia the small amount of forest land held by the Crown is leased for varying terms from one year up to 99 years; in New Brunswick there is now a fixed term of twenty years with the right to renew for ten or twenty years under certain conditions; in Quebec, Ontario and the Prairie Provinces the leases are all annual in form. In Quebec, it is stated that where the land is unquestionably non-agricultural the leases have, through custom, become practically perpetual and the government has announced that it will not change the terms oftener than once in ten years. In Ontario, the Crown has always contended that the leases were for one year only and that while it renews them from year to year on non-agricultural land, it can at any time terminate the lease by giving six months' notice. It has also announced that it will not alter its dues and ground rents oftener than once in ten years. Recent sales in Ontario have been by auction for a rate per thousand feet, board measure, of the standing timber. There are no dues or bonuses and the purchaser is given a limited time in which to take off the timber, after which the land reverts to the Crown.

British Columbia has recently made an elaborate revision of its system. By this revision most of the leases become perpetual but the government takes power to revise the terms every five years. These dues are fixed on a basal price for lumber at the mill. If at the end of any five year revision period the price shall have risen above this base price then the government will take an increased royalty or tax in proportion to the increased price.

All the governments make provision for fire protection and have called upon the lumbermen to pay an increasingly large proportion of the cost of this protection on lands leased to lumbermen; the governments, of course paying the whole cost of protection on the areas of forest land where the Crown has not yet parted with the right to cut the timber.

The policy of forest reserves, that is of land unsuited to agriculture set apart to grow timber for ever, is a recent development in Canada and the method of conducting operations on these reserves is one of the administrative problems now being worked out in this country.

Methods of Canadian Lumbering.

All of Eastern Canada drains into the Atlantic through great lakes and rivers. The great forests were on the banks of these rivers and their tributaries. This was also largely true of British Columbia in respect to the Pacific, so that with comparatively small exceptions all of Canada's lumbering operations have been carried on by water. Under this system the trees are felled in the autumn and winter, drawn by horses to the rivers and

streams and piled on the ice which at that time covers the surface. When the rivers break up in the spring the freshet carries the logs with it out to the mouths of the rivers, where they empty into the great rivers like the St Lawrence or Ottawa or the great lakes like Huron or Ontario. Here the logs are boomed (1) and the logs of the different owners separated by means of the timber brands on the ends of the logs. The logs thus separated are sawn into boards and planks in the mills located along the river bank.

The practice is now prevalent of bringing the mills as close as possible to the forest and shipping out only the finished product, but in the early days the mills were located at lumber centres on the great rivers and the logs were formed into rafts and these rafts were floated down the rivers, run over rapids and towed across lakes to the mill. For many years the export trade consisted largely of square timber, that is timber squared by the axe in the woods. This trade, which employed many hundred sailing ships, had its centre at the port of Quebec, where sometimes as many as three hundred ships were to be seen loading at one time. It reached its highest point about 1870 and since that, owing to the wastefulness of the trade and the dangerous condition in which it left the woods, owing to the chips and debris, it has been attacked from both the commercial and legislative sides and had dwindled away to almost nothing.

Nowadays the steamer, schooner or barge carries the sawn lumber from the lake port or river town to the seaport where it is loaded on ocean-going ships. The method thus differs from those employed in the United States, where the transportation is largely done by logging railways. This water transportation feature with the risks and dangers attending the "driving of the logs down the small streams and, attending the "booming" and "rafting" and "shooting" of rapids and running of "log-chutes", has bred up a hardy, adventurous class of men equally skilful in the use of the axe, the pikepole (2) and the paddle, and has developed a literature in prose and verse which has forever given a touch of romance to Canadian lumbering.

The Forest Trees of Canada

by

R. G. LEWIS.

Coniferous forest growth prevails over the greater part of Canada's potential forest area. If we eliminate from our conception of potential forest

(1) "Boomed"; that is floated into great enclosures formed of floating logs chained together end to end and anchored to piers set in the river. As the logs float through a narrow entrance the river men or "log drivers" skilfully direct them into the enclosures of the different owners as indicated by the brands or marks on the logs.

(2) The pikepole is a pole fifteen or twenty feet long fitted with a sharp spike and hook at one end, which pole the river "driver" uses to balance himself as he walks along the floating rolling logs, and to draw the logs into the desired channels or away from rocks.

that which grows on land fit for agriculture we eliminate most of the hardwood forests of commercial value. In the rigorous climate of Canada deciduous-leaved trees, as a general rule, are found in commercial sizes and quantities only on the better sites. Where coniferous forests are destroyed by fire or lumbering operations and deciduous-leaved trees, such as the birches and poplars, establish themselves by means of their light wind-borne seeds, the change is only a temporary one. The original coniferous forest will eventually re-establish itself by its more persistent growth.

In Canada there are approximately 150 different species and varieties of trees. Only 32 of these are conifers but the wood of these forms 95 per cent of our forest products, and the trees themselves cover an even larger proportion of our potential forest area.

While the actual number of species of deciduous-leaved trees seems large in comparison to their commercial importance, out of a total of some 118 species and varieties, only four or five are worthy of comparison with the conifers. The others form the northernmost fringe of the great interior hardwood forest type of the United States. Many of these species are confined in Canada to a narrow strip of territory along the north shore of Lake Erie and as far as the discussion of Canada's timber resources are concerned they may be classed with exotic tree growth.

The five native spruce species are all of commercial importance. Spruce ber formed over one third of the total output of Canadian sawmills 1914. Spruce pulpwood is used in preference to all others and in the me year formed over two thirds of the total quantity of pulpwood nsumed in Canadian pulpmills and exported in the raw or unanufactured state. The wood has a long, tough, colourless fibre and ing free from resin is considered to be the best material for pulp anufacture on the market of the world.

Spruce is also used for railway ties or sleepers, telegraph, telephone and ectric light and power line poles, cooperage, mining timbers, fencing and ewood. Of the five native spruce species the white spruce (*Picea canaisis*) is the most abundant and the most important commercially. With ack spruce (*Picea mariana*) it ranges from Labrador to Alaska, extending rthward almost to the limit of tree growth and southward into the nited States. Toward the northern limits of its distribution the tree, of ourse, does not reach commercial size being in many cases little more than prostrate shrub.

The black spruce (*Picea mariana*) is of less value, being a smaller, slow-rowing tree, often confined to swampy situations and reaching saw log r pulpwood sizes only under more favourable conditions of growth. The ed spruce (*Picea rubra*) is confined in its distribution to the Province of uebec and the Maritime Provinces. Its wood is considered to be of greater chnical value than that of the other spruce species, but it is not usually o abundant on the market as the white spruce. The western species (*Picea ngelmanni* and *Picea Sitchensis*) are not found east of the Rocky Mountins and their utilization is confined to the Province of British Columbia, ey being essentially Pacific Coast trees. Their wood is of high technical

value and can usually be obtained in larger dimensions than that of the other spruces, as the trees attain great size in this region.

As their distribution is restricted and as they are found growing with trees of greater commercial value, their lumber does not assume great national importance at the present time.

There are nine distinct pine species native to Canada, and of these, six are of great commercial importance. The eastern white pine (*Pinus Strobus*) is the most valuable coniferous wood in Canada. It has superior qualities for the wood worker and enjoys a world wide reputation. Up to a few years ago it was the most important wood in Canada in point of quantity of lumber sawn and exported in the form of square timber (Quebec pine). Owing to increased scarcity of good material the wood has fallen off in production till its place has been taken at the head of the list by the spruces of which there is a greater supply of available material. The wood of white pine is soft, easy to work, fairly durable and strong in comparison to its weight. Its most valuable quality in addition to these is its faculty to holding its shape with a minimum of shrinking or swelling once it has been properly seasoned. In this latter respect there are a few woods of commerce that can surpass it. The western white pine (*Pinus monticola*) is similar in most respects to the eastern species. It is a smaller tree, of comparatively rare occurrence and is of minor commercial importance. In distribution it is confined to the province of British Columbia while the eastern white pine is found from eastern Manitoba to the Atlantic seaboard. The remaining pine species are sometimes classed as "hard pines", their wood being harder and more resinous than that of the "soft" or white pines. The red or Norway pine of eastern Canada and the western yellow or "Bull" pine of the interior of British Columbia (*Pinus resinosa and ponderosa*) are valuable sources of light structural timber and are also sawn into lumber. The two jack pines (*Pinus Banksiana* of the east and north and *Pinus Murrayana* of the Rocky Mountains and British Columbia) are not considered as valuable timber producing trees although they are both used locally for rough construction. Jack pine railway ties are used to an enormous extent on the newly constructed transcontinental railway lines as the wood is handy to the right-of-way and can be obtained in sufficient quantity with a minimum of haulage. In 1914 over forty per cent of the ties used in Canada were of this wood. Its cheapness and abundance are its most important characteristics in this respect. In the manufacture of "Kraft" pulp by the sulphate process it has been found that jack pine is a satisfactory raw material and the use of the wood for this purpose has increased in the last few years very greatly. There are three other species of the genus Pinus that reach tree size in Canada, but these are only of local importance for firewood.

The Douglas fir (*Pseudotsuga mucronata*) often erroneously called "Oregon Pine", of British Columbia and the Pacific Coast is the only representative of its genus in Canada. It yields more lumber annually than any other single species in America. The cut in Canada represents over per cent of the total lumber production. The tree in Canada is not found east of the Rocky Mountains, the greater part of the lumber being obtain

the Coast Region of British Columbia. This is Canada's largest tree from it larger timbers can be obtained than from any other tree in erica, with the single exception perhaps of the California Redwood (*Se-ia*). Up to the present time its use has been largely confined to structural poses but its attractive grain and figure are winning for it popula- as a wood for more decorative purposes such as interior finish and ca- et work. The wood comes fourth in importance in Canada as a material railway ties and is used extensively for mining timbers. It is noted efly for its strength and durability and the dimensions in which it can obtained.

There are three hemlock species in Canada's forests, two of which are uable timber trees. The eastern hemlock (*Tsuga canadensis*) is abund- throughout its range in the eastern provinces, but is not found west the province of Ontario.

The wood is used chiefly for rough, cheap construction especially house ming. It is fairly strong but has many objectionable features from the odworker's standpoint, being rough, harsh, splintery, and difficult to rk. It is not durable in contact with moisture but supplies the demand a cheap, strong material for many purposes. The wood is also used for lway ties, poles, mining timber, pulpwood and firewood. Its bark is valuable source of tannin. The western hemlock has few of the objec- nable technical features of its eastern relative. This tree (*Tsuga hete-phylla*) is found in Canada only in the province of British Columbia, and becoming more valuable each year as the prejudices due to its name are ercome. The two trees in Canada in 1914 yielded over eight per cent the total lumber production of the country.

There is only one balsam fir in eastern Canada (*Abies balsamea*). The e is found from Labrador to Alaska covering practically the same geo- phical distribution as the white and black spruces. Its wood is sawn o lumber to take the place of more valuable woods for rough construc- as it has few technical qualities which would recommend it for any other as lumber. The purpose for which the wood of this tree is best suited the manufacture of wood pulp for paper making. The tree, in nature, rs mixed with spruce and it is cut and marketed with that wood. Bal- fir has the requisite length and toughness of fibre for pulp making and spite of the fact that it gives a slightly lower yield of pulp per cord and tains a higher percentage of resin than spruce its use is increasing. In 4 one fourth of the pulpwood cut was of this species.

There are three western balsam fir species whose wood is very similar that of *Abies balsamea*. The most important of these at present is pro- ly the Alpine fir (*Abies lasiocarpa*) Where these western species are uti- d their wood is put to similar uses to those of the eastern species. They confined in their distribution to the Rocky Mountains and the Pacific pes.

There are only two species of the genus *Thuya*, commonly called dar" in Canada. They are both of great commercial importance, each its own region, as their ranges do not overlap. The wood of the cedars

is the most durable of the conifers of the Dominion. The eastern tree white cedar (*Thuya occidentalis*) is found from the Atlantic to the south-easter part of Manitoba. It does not extend as far north as some of the othe conifers and is nowhere very plentiful, being confined to moist situations The wood has become so scarce in Eastern Canada that the supply is no equal to the demand and the market for a light, durable wood is being partly filled by imported cypress (*Taxodium distichum*) from the southern United States. Cedar is preferred to all other native woods for shingles and all structural work exposed to moisture. In spite of the fact that th wood is not strong, its great durability in contact with the soil makes i valuable railway tie material. In 1914, this wood came second on the l for railway ties purchased by Canadian railways. It is used in enormo quantities both locally and for export for fence-posts and its use for t purpose is largely responsible for the increased scarcity of the lumber, young trees are used before they have time to reach saw log sizes. T western red cedar (*Thuya plicata*) is one of the giants of the Pacific Coa being only surpassed in size by Douglas fir. Its wood is sawn into lumb of large dimensions and is made into shingles to a greater extent than an other wood in Canada.

Birch is Canada's most important hardwood and one of the few woo of this class where the exported material exceeds that imported. The are at least seven native species but only two are worthy of any detail discussion. The yellow birch (*Betula lutea*) is the source of the most va able birch lumber used for flooring, furniture, cabinet work and vehi stock. The tree grows only in Ontario, Quebec and the Maritime Pr vinces and does not reach commercial dimensions north of the height- land between the St. Lawrence River and Hudson Bay. Its wood is ha heavy, strong and tough but is not durable in contact with moisture.

The paper birch (*Betula alba* var. *papyrifera*) has a much wider dis bution and is more abundant in its range, being common from the Atla to the Rocky Mountains. Its wood is softer, weaker and less durable th the yellow birch and is not at present of great commercial value. I usually considered as a "weed tree", as it springs up with marvelous a rity on burned-over or cut-over areas. It has certain qualities of tou ness and compactness which will in time win it a place among our more portant woods when these qualities are better understood. The tou resinous bark of this tree has supplied the aborigines for centuries with material for covering their famous "birch bark canoes".

Of the three native tamarack or larch species, two are worthy of n The eastern tamarack (*Larix laricina*) is found in every province in th minion in swampy situations. Its wood is hard, strong and durable, l similiar to that of Douglas fir and the Southern hard pines. The we larch (*Larix occidentalis*) is more important commercially. It is found in British Columbia but grows on better sites and reaches greater size the eastern tree. The wood of these two species together is cut into lu and also used for railway ties, coming third on the list in 1914, and for mi timbers and fencing.

The maple, whose leaf is the national emblem of Canada, is our se-
nd most important hardwood and is represented in Canada by nine or
ore species scattered from the Atlantic to the Pacific. Only one species
wever can be considered here. The sugar maple or hard maple (*Acer sac-
arum*) produces the most valuable lumber and, like birch, is used for furni-
re, vehicle stock and interior house finishing. The sap of this tree is the
urce of maple syrup and sugar.

Basswood (*Tilia americana*) is a valuable wood for cabinet work of
l kinds but being restricted in distribution and in great demand the avail-
ble supply has almost disappeared, It formed less than one per cent of
e lumber produced in Canadian sawmills in 1914.

Elm, represented by three species in Canada, is a valuable vehicle
ood. Beech, ash, oak, butternut, chestnut, hickory, cherry, black wal-
ut, tulip, black gum, red alder, sycamore and sassafrass are all valuable
oods and are still sawn into lumber in Canada, but in most cases the supply,
hich was never large, has dwindled almost to insignificance.

The poplar species, of which there are seven native to Canada, are for
most part considered as "weed trees" but, like paper birch and jack
e they produce great quantities of material which will eventually be-
ne valuable at least for some purpose when their qualities are better
preciated and when the scarcity of the more valuable of better understood
ods will make their careful utilization imperative.

The following is a list of the important tree species of Canada and some
the minor ones. The nomenclature is in accordance with GRAYS'S BOTANY
d the common names given are those used by the Forestry Branch of the
partment of the Interior. These latter names have been chosen with the
e idea of conforming as closely as possible with names in common use
lumbermen and foresters in Canada but where duplication of names has
ven rise to confusion the most suitable name has been chosen.

CANADIAN TREE SPECIES.

I. — Conifers.

Pinus	*Strobus*	White pine
"	*monticola*	Western white pine
"	*flexilis*	Limber pine
"	*albicaulis*	White-barked pine
"	*ponderosa*	Western yellow pine
"	*rigida*	Pitch pine
	resinosa	Red pine
"	*Murrayana*	Lodgepole pine
"	*Banksiana*	Jack pine
Larix	*laricina*	Tamarack
"	*occidentalis*	Western larch
"	*Lyallii*	Alpine larch
Picea	*Mariana*	Black spruce
"	*rubra*	Red spruce
	canadensis	White spruce
"	*Engelmanni*	Engelmann spruce

" *sitchensis*	Sitka spruce
Tsuga canadensis	Hemlock
" *heterophylla*	Western hemlock
" *Mertensiana*	Black hemlock
Pseudotsuga mucronata	Douglas fir
Abies balsamea	Balsam fir
" *amabilis*	Amabilis fir
" *grandis*	Lowland fir
" *lasiocarpa*	Alpine fir
Thuya occidentalis	Cedar
" *plicata*	Western cedar
Chamæcyparis nootkatensis	Yellow cypress
Juniperus communis	Juniper
" *virginiana*	Red juniper
" *scopulorum*	Rocky Mountain juniper
Taxus brevifolia	Western yew.

II. — Hardwoods.

Juglans cinerea	Butternut
" *nigra*	Black walnut
Carya cordiformis	Bitternut hickory
" *ovata*	Shagbark hickory
" *alba*	Mockernut hickory
" *glabra*	Pignut hickory
Populus tremuloides	Aspen
" *grandidentata*	Large-toothed aspen
" *balsamifera*	Balsam poplar
" *angustifolia*	Narrow-leafed cottonwood
" *acuminata*	Lance-leafed cottonwood
" *trichocarpa*	Black cottonwood
" *deltoides*	Cottonwood
Salix sp.	Willow
Carpinus caroliniana	Blue beech
Ostrya virginiana	Ironwood
Betula lenta	Sweet birch
" *lutea*	Yellow birch
" *populifolia*	White birch
" *alba* var. *papyrifera*	Paper birch
" *occidentalis*	Western birch
" *alaskana*	Alaska birch
" *fontinalis*	Mountain birch
Alnus sitchensis	Sitka alder
" *oregona*	Oregon alder
" *tenuifolia*	Mountain alder
" *incana*	Speckled alder
Fagus grandifolia	Beech
Castanea dentata	Chestnut
Quercus rubra	Red oak
" *palustris*	Pin oak
" *coccinea*	Scarlet oak
" *velutina*	Black oak
" *alba*	White oak

" *Garryana*	Garry oak
" *stellata*	Post oak
" *macrocarpa*	Burroak
" *bicolor*	Swamp white oak
" *prinoides*	Dwarf Chinquapin oak
" *prinus*	Chestnut oak
" *Muhlenbergii*	Chinquapin oak
Ulmus americana	White elm
" *racemosa*	Rock elm
" *fulva*	Red elm
Celtis occidentalis	Hack berry
Morus rubra	Red mulberry
Magnolia acuminata	Cucumber tree
Liriodendron tulipifera	Tulip tree
Asimina triloba	Papaw
Sassafras variifolium	Sassafras
Hamamelis virginiana	Witch hazel
Platanus occidentalis	Sycamore
Pyrus americana	Mountain ash
Amelanchier canadensis	Service berry
" *spicata*	Saskatoon
Cratægus sp.	Hawthorn
Prunus nigra	Canada plum
" *pennsylvanica*	Bird cherry
" *emarginata*	Bitter cherry
" *virginiana*	Choke cherry
" *demissa*	Western choke cherry
" *serotina*	Black cherry
Cercis canadensis	Red bud
Gymnocladus dioica	Kentucky coffee tree
Rhus typhina	Staghorn sumach
Acer spicatum	Mountain maple
" *pennsylvanicum*	Striped maple
" *macrophyllum*	Broad-leaved maple
" *circinatum*	Vine maple
" *Douglasii*	Dwarf maple
" *saccharum*	Sugar maple
" *saccharinum*	Silver maple
" *rubrum*	Red maple
" *Negundo*	Manitoba maple
Tilia americana	Bass wood
Nyssa sylvatica	Black gum
Cornus florida	Flowering dogwood
" *Nuttallii*	Western dogwood
Arbutus Menziesii	Madrona
Fraxinus quadrangulata	Blue ash
" *nigra*	Black ash
" *americana*	White ash
" *pennsylvanica*	Red ash
" *pennsylvanica* (var. *lanceolata*)	Green ash
" *oregona*	Oregon ash

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

ELOPMENT OF ICULTURE DIFFERENT UNTRIES

956 – **The Agricultural Products of Portuguese Guinea.** — MACHADO DA FONSECA JOA QUIM., in *Revista Agronomica*, XIth year (2nd Series), Vol. 2, Nos. 13-16, pp. 45-[illegible], 1 diagram + 1 map. Lisbon, 1915.

Report on a voyage of agricultural exploration carried out with a view to organisation of the colonial agricultural services in the province of Portuguese Guinea, by the order of the Portuguese Government, together with replies to a detailed list of questions prepared by the Government of the Colony and the General Direction of Colonies.

SOIL. — The cultivable soils of this province are generally clayey-humous limestone. They are sometimes, but rarely, richer in clay; others of them again (those of Cacheu) are rather sandy. Being generally very fertile they need no manuring, and are admirably adapted for the intensive cultivation of all tropical plants. From 10 analyses of soils made at the superior Agronomic Institute at Lisbon the following data representing extremes are obtained :

Composition of Soils in Portuguese Guinea.

	‰		‰
Fine earth	958-1000	Nitrogen	0.58-1
Moisture	12- 48	Phosphoric acid	1.47-3
Organic matter	32- 146	Potash	0.5-1.

The predominating cultivations are the following :

CEREALS. – Rice and maize form the bases of native foods. Mountain rice is cultivated on the following method : after the first rains the weeds are pulled up and burnt, the ashes spread over the land, the latt

king given a superficial cultivation, the seed is sown broadcast, and weed-ng is continued until harvest. Paddy is treated in the following manner: rom the end of May to June the seeds are sown; the plantlets are transplant-d one by one when they have reached a height of 6 to 8 inches; the rice eld is kept free from weeds and is flooded. With the weeds which have een pulled up and afterwards stacked small dykes are made. The crop i got in from December to March. To sow 1 acre, from 11 ½ to 12 bushels f rice are used. The average crop is from 44 ½ to 47 bushels per acre. he market price is 1*s.* 2 ½ *d.* per gallon for the paddy, and 1 *s.* 7 ½ *d.* per gall. or the rice not in husk. There are also grown: *Zea Mays, Pennisetum phoideum, Andropogon Sorghum*, etc.

LEGUMINOUS CROPS. — Beans are chiefly grown.

STARCH CROPS. — Sweet and bitter cassava and the sweet potato e chiefly cultivated.

TEXTILE PLANTS. — The cotton plant is grown, though to a limited tent, in the regions of Farim, Bolama, Bafatà, Buba and Cacine in conse-uence, undoubtedly, of a distribution of seeds made some years ago by the overnment. In the region of Farim, the writer observed specimens of *ossypium herbaceum* and *G. barbadense* of excellent growth and abundantly roductive. With the cotton the natives manufacture certain articles for eir personal use.

CROPS YIELDING OIL. — *Arachis hypogea* in cultivated to a large ex-ut on the following method: After the first rains, that is from the end of ay to the month of July, the soil is superficially dressed, after which sow-g is done in rows at the rate of 40 to 44 ½ lbs. of seed per acre, the seed ing afterwards covered. The crop is taken off from December to arch. The average unit production is 1 340 to 1 600 lbs. per acre. The erage selling price on the market is 0.73 *d.* per lb. The ground nut not cultivated by the natives alone, but also on lands granted to nites. *Sesamum indicum* is used, but is not cultivated.

The trees or shrubs producing oil seeds or fruits are: *Elaeis guineen-; Carapa Touloucouna, Ricinus communis*, and, in addition, a shrub med by the natives "arcus", etc. *Elaeis guineensis* forms very extensive rests. It is not very productive however (13.2 lbs of kernels and 0.66 llons of oil per tree) and is poor in growth owing to the incisions made th the object of extracting the sap, with which palm wine is manu-ctured. The exportation of coconuts is carried on to some small extent, t could be very much extended.

RUBBER PLANTS. — The wild rubber producing plants (*Landolphia udelottii* and *L. senegalensis*) are utilised direct by the natives in the re-ns of Farim and Batafà. The latex is gathered from November to May, the use of primitive and destructive methods, namely, by incision, re-oval of the bark or felling of the trees. It is coagulated by leaving it posed to the air in the presence of salt and tamarind juice which is found abundance. It is dried in the sun, then shaped into balls and sold in form. The dried rubber fetches 3 *s.* and the "green" rubber 1 *s.* 5 *d.* lb. There are no rubber plantations in the true sense of the word. The

rubber is exported from Portuguese Guinea to Hamburg, Marseilles and Havre. In 1912 there were exported 500.300 lbs. of a declared value of some £ 79 410. The writer believes that by prohibiting the burning of the wood and teaching the natives the use of a more rational method in gathering and coagulating, this production could be greatly increased and improved.

STIMULATING AND NARCOTIC PLANTS. — *Coffea arabica* and *C. liberica* grow in the regions of Bolama, Buba and Cacine; *Theobroma Cacao* at Bijagós; *Sterculia acuminata* at Cacine. These plants thrive excellently but produce little owing to complete absence of cultivation. Recently the "Companhia Commercial Agricola dos Bijagós" began cocoa cultivation by means of imported seeds. The results hitherto obtained justify hopes of great success.

SUGAR PLANTS. — The sugar-cane is cultivated in the regions of Farim and Batafà, which, according to the writer, are best adapted for this cultivation. The mean annual temperature there is from 77 to 78.8° F. The rainy season occurs between May and October, and for the rest of the year the weather is dry; the lands are chiefly low and moist, of clayey humus-limestone composition. Several navigable streams can supply non-brackish water for irrigation, and also serve as easy and cheap ways of communication. The population is sufficiently dense to furnish the necessary labour. In the plantations, all of which are conducted by settlers, the sugarcane cuttings are generally planted at 20 inches distance in furrows 15 3/4 to 23 1/2 inches wide and 12 to 20 inches deep, 3 ft. 3 in. to 4 ft. 11 in. apart. For multiplication the best shaped canes, still green, are selected. The middle part is reduced to fragments which are placed aslant in the furrow. The sowing work is carried out from March to May, and no manure is used. The after-management consists in weeding and keeping the irrigation ditches clear. This is a system which may be described as natural, because the sugarcane is grown along the rivers. The waters of the latter are forced up once a day by high tide, and rise to such an extent as to fill the irrigation ditches which are arranged perpendicularly to the bed of the streams in question. Eight months after sowing, the cane is ripe. The crop is gathered from December to May. The plantation is renewed every 3 years, that is after 3 crops. No sugar is manufactured. The whole of the cane grown is devoted to the production of alcohol. The juice yield of the cane is 48.5 % and the sugar yield 13%. This region is admirably suited for sugar-cane growing, but is cultivated by 15 settlers only over a total area of 84 acres. The natives do not carry on this cultivation. In 1913, 790 675 lbs. of sugar were imported into Portuguese Guinea.

HORTICULTURE. Many green vegetables are cultivated, which grow with surprising rapidity.

ARBORICULTURE AND SYLVICULTURE. Among the most common fruit trees, the writer mentions: *Anacardium occidentale*, the pine-apple, *Psidium Guajava* (cultivated), orange, lemon, *Carica Papaya*, all cultivated then: prickly pears, tamarind, banana and *Zizyphus Jujuba*, utilised, but not cultivated.

The regions of Farim and Batafà are exceedingly rich in timber trees, such as: *Swietenia Mahogani*, *Hasskarlia didymostemon*, *Milletia* spp. ("pau ferro"), *Dalbergia melanoxylon*, *Bombax* spp., *Borassus flabellifer* (of which the fibres are also utilised), *Adansonia digitata*, the fruit of which is medicinal, etc.

957 - **Agricultural Education in Chile. — The Agronomic Institute of Santiago.** — VALDIVIA URBINA, in *La Vie agricole et rurale*, VIth year, No. 26, pp. 465-466. Paris, June 24, 1916. AGRICULTURAL EDUCATION

In 1842, under the auspices of the *National Society of Agriculture* there was founded in Chile the first practical School of Agriculture, the direction of which was entrusted to a Spanish specialist, DON MANUEL DE ARANA BORICA.

Having been reorganised later on by an Italian scientific agriculturist, DON LUIS DE SADA, it was established on a fine farm covering more than 330 acres situate on excellent alluvial soil about 10 feet deep, the said farm having been bought by the Government from General DON MANUEL BULNES, on the very outskirts of Santiago, the capital of Chile.

This institution was organised on the model of the European schools of agriculture, and was given the name of *Quinta Normal*, "Normal Farm".

Higher agricultural education began in 1873, by the creation, in the University, of a Chair of agriculture occupied by an agricultural engineer from Grignon, a Frenchman, M. LE FEUVRE; there was afterwards created a chair for the science of livestock-breeding etc., which was filled by another French agricultural engineer, M. JULES BESNARD.

In 1874 there was founded at the *Quinta Normal* an establishment for higher agricultural education which assumed the name of "agronomic Institute", and of which Messrs. LE FEUVRE and BESNARD undertook the direction.

After numerous exhibitions organised by the *National Society of Agriculture*, and which afforded a clear view of the progress achieved in the agricultural department, the Ministry of Public Works created a department for the Promotion of Agriculture and the Inspection of Agricultural Education.

At the present time, all the agricultural Services are under the Ministry of Public Works and subject to supervision by the Inspection service last mentioned, except with regard to the Forest Inspection Department created recently, which is directly subordinate to the Ministry of Public Works.

These services comprise:

An Office of Agricultural Statistics; the Agronomic Institute of Santiago; five Practical Schools; a Station of scientific Agriculture, Oenology, Plant Pathology, and Meteorology; a Veterinary Hospital; four Services of Regional Agricultural Engineers, who play a part similar to the French departmental professors.

The area occupied by the "Quinta Normal" of Santiago is divided as follows (1 hectare = nearly 2 $\frac{1}{2}$ acres).

	Hectares	Ares	Centiares
Park land	26	93	13
Glass houses and winter gardens	—	49	33
Experimental fields	—	35	78
Zoological garden and Veterinary hospital	2	31	95
Pleasure garden	1	24	58
Kitchen and Fruit garden	2	34	90
Fruit tree nurseries	—	26	—
Orchard	1	77	20
Forest and ornamental trees	5	6	65
Vineyard	20	97	59
Practical schools and plots annexed	2	68	41
Stables and sheds	—	65	82
Groves, thickets, etc.	2	59	4
Annual forage plants	8	—	—
Temporary grassland	22	—	—
Grain crops	6	—	—
Weeded crops	3	6	—
Industrial plants	4	—	—
Gardens for Live-stock shows	2	31	50
Botanical gardens	2	70	27
Astronomical observatory	1	69	1

The object of the Institute is to train up: farmer landowners or managers possessing the necessary scientific knowledge for the best working of the soil: technical managers for agricultural industries; directors for the public departments connected with agriculture; professors and assistants for agricultural education at the Institute itself and in the practical schools.

Students are admitted after a competition from which only bachelors of science are exempted. Candidates must be seventeen years old at least.

The period of study is four years, after which those students who have maintained a sufficient average standard receive the diploma of Agricultural Engineer.

The school year begins in March and ends in December.

The Institute, in addition to regular students, admits free students desirous of following a special course in one subject; the duration of their stay in the Institute is limited to two years.

Education is entirely free, as is indeed the case in all educational establishments in Chile.

It comprises the following courses:

1. General agriculture: (*a*) agricultural climatology; (*b*) study of soils, manuring and manures; (*c*) plant reproduction.
2. Special agriculture: (*a*) agricultural work; (*b*) cultivation of food plants, industrial plants and grasslands.
3. Arboriculture for forest, fruit and ornamental trees, and horticulture.
4. Vine-growing and wine-making.
5. Plant physiology and micrography.
6. Plant pathology and agricultural entomology.
7. Sylviculture.
8. Applied organic chemistry.
9. Agricultural chemistry.
10. Analytic chemistry (quantitative).

11. Animal anatomy and physiology.

12. Elements of veterinary medicine: (*a*) pathology and pathological anatomy; (*b*) materia medica; (*c*) veterinary clinic.

13. Livestock: (*a*) external structure of animals; (*b*) general science of livestock; (*c*) applied zootechny; (*d*) forage and rational feeding of cattle; (*e*) poultry-keeping, bee-keeping and silkworm-rearing.

14. Farm engineering: (*a*) surveying, levelling, general mechanics, agricultural mechanics (agricultural machinery and motors); (*b*) hydraulics (irrigation, drainage, etc.); (*c*) farm buildings, geometric drawing, freehand drawing, topographical and mechanical drawing.

15. Agricultural industries (technology) comprising the industries of greatest interest to the country: (*a*) manufacture of alcohol; (*b*) dairy industry; (*c*) food preserves; (*d*) textile material, etc.

16. Applied hygiene.

17. Rural and *consular* legislation.

18. Economics, farm accounts and consular information.

For demonstrations and practical applications of the courses, the Institute possesses, in addition to a library of 6,000 volumes, which receives a large number of agricultural publications, a museum of agricultural products, appliances and machinery. Important annexes are made up of:

Experimental field. Weather observatory. Laboratories of: technology, with models of technological plant; agricultural chemistry; plant botany and pathology; seed tests and agricultural distillery. Dairy serving both for cheese and butter making. Vineyard with wine store and wine cellar. Vine nursery. Orchard. Kitchen garden. Hot-house for plant propagation. Section for fruit, forest and ornamental shrubs. Section for the growing of the principal plants under field conditions (industrial, food and forage). Section concerned with domestic animals for breeding and farm work. Stud animal section. Byre for livestock experiments and a veterinary hospital.

From the second year onwards the courses are supplemented by visits to farms, factories of agricultural products etc., in which the students are accompanied by the professors and assistants.

The costs of these excursions are defrayed by the Government, which appropriates a special credit for that purpose every year and places first-class tickets at the disposal of the Institute.

Every year the Institute organises an excursion of one month for fourth year students, with the object of making them acquainted with the different agricultural regions of the country and their special qualities.

The State, on that occasion places at the disposal of the students a first class carriage, one half of which is converted into a sleeping-car, and an ordinary carriage converted into a kitchen and restaurant car, which carriages can be hooked on to any train.

The students are put through monthly examinations and general examinations at the end of each school year. Those among them who have secured a sufficiency of marks at the general examinations in the previous years undergo a final general examination at the close of the fourth year.

They are furthermore required to produce a report proving that they have been through a probationary period on a farm. Every year the students who have passed their graduation examination are sent on a mission abroad at the Government expense.

958 - **Reorganisation of Agricultural Education in Colombia.** — *Revista agricola, Organo del Ministerio de Agricultura y Comercio*, IInd Year, No. 2, p. 65. Bogota, February 1916.

Decree No. 123 of the 31st January 1916 provides for the reorganisation of the National Agricultural and Veterinary Institute under the name of " Instituto nacional de Agronomía ". The following are to form part of the National Agronomic Institute : the practical schools of Agriculture, the stations of scientific agriculture and experimental fields, founded in the capital or in other localities of the Republic. The director of the School and the technical chiefs of the experimental services of the Station of scientific agriculture will form the technical Council of the corresponding Station which must reply to enquiries by the Ministry of Agriculture and Commerce as well as to those of the public, on questions of scientific agriculture, livestock and protection of plants against diseases and pests.

CROPS AND CULTIVATION.

PHYSICS, CHEMISTRY AND MICROBIOLOGY

959 - **Contribution to the Study of the Forms in which Phosphoric Acid occurs in the Soil.** — JEGOROV M. A., in *Южно-русская сельско-хозяйственная Газета* (The Agricultural Gazette of Southern Russia). Nos. 13-14 and 15, pp. 4-5 ; 4-5. Kharkov, April, 1916.

In the study of the problem of the phosphoric acid of the soil, the question of the forms in which it occurs is fundamental, and by a knowledge of these we may attain to a solution of the important problem of the dynamics of soluble phosphoric acid in the soil in relation to the cultivable condition of this latter. Starting out from this idea, the above writer, together with J. J. STOZKIJ and P. P. GRETCHIANINOV, conducted experiments with a view to determining the quantity of organic phosphoric acid contained in " podzol " and " tchernoziom " earths.

The investigators adopted the following method of separation, which perfectly well answers the purpose, as was shown by 2 years of work : the earth, first washed with 3 % hydrochloric acid, is afterwards treated with a 3 % solution of ammonia. The resulting solution is passed through porous filters, and the filtrate precipitated with acetate of lead. The precipitate is carefully washed, treated with sulphuretted hydrogen to eliminate the lead, and dissolved again in dilute ammonia. It is then filtered, the filtrate is concentrated and afterwards treated with ether, which separates the organic combination of phosphorus which it is proposed to study from the mineral phosphoric compound which might be present.

The soils used for these experiments were : " Podzol " from the farm of the Agronomic Institute of Moscow, with an average of 0.0532 % of phosphoric acid ; the " tchernoziom " of the government of Kursk, with an average of 0.110 % ; and " tchernoziom " of the government of Ufa, with an average of 0.145 %. The ammoniacal solutions contained respectively 52.7, 55.18 and 30.41 % of the total phosphoric acid of these earths, in other words, about one half in the case of the first two, and one third in the last.

The workers succeeded in obtaining considerable quantities of organic hosphoric acid. In one case it represented 17.67 % of the total phosphoric id content of the soil, and in another, 10 %. There is reason to believe at higher percentages would be obtained in proportion as the method pplied to this investigation is improved.

By these means, in the "podzol" and "tchernoziom" the presence f a considerable proportion of phosphoric acid in the form of an organic ombination which appears to be one of the nucleinic acids was definitively stablished. The ascertainment of this fact does not yet furnish the required nswer to the question of the dynamics of phosphoric acid in the soil. Nevertheless, in view of the fact that J. J. STOZKIJ succeeded in proving hat with 3 % hydrochloric acid not only mineral but also organic phosphor- c acid is extracted from the soil, and that probably a substantial propor- ion of this mineral phosphoric acid in the hydrochloric solution is not of mineral but of organic origin, and that it becomes mineral in the process f evaporation of this solution, then the importance, not merely theoreti- al but also practical, of investigations of this kind will become clearly evid- nt. Bearing this in mind, and also the fact that the best results on "tcher- oziom" are obtained by means of phosphate manure in spite of the ichness of that soil in phosphoric acid, the writer suggests the possibil- ty of overcoming the condition of inertia of the large stores of phosphoric cid contained in the soil by a knowledge of the dynamics to which its pre- ence therein is subject.

Finally, it may be presumed that the organic combinations of phos- horus differ according to the soils, and it is highly desirable that investi- ators should in a greater degree devote their attention to this point.

660 - **Method of Sterilisation and Chloroforming of the Soil in the Study of the Properties of "Tchernoziom".** — SKALSKIJ S. in *Южно-русскій сельскохозяйственный Газета* (*The Agricultural Gazette of Southern Russia*), Year XVIII, Nos 1; 2; 5; 7 and 9; pp. 7-8; 6-7; 5-7; 9-10. Kharkov, January-February-March 1916.

On the basis of his experiments carried out in the laboratory of bacteriological chemistry of the agricultural experiment Station of Ploty (Russia) the writer proves that under the influence of fertilisation and chloroforming the fertility of the tchernoziom increases. He ascertains the degree of such increase, and, to the extent permitted by the results obtained, explains the modifications which take place in the sterilised and chloroformed tchernoziom and which produce the increase in its fertility. The experiments were conducted in the following way :

Small WAGNER vessels to the number of two for each experiment were filled with tchernoziom, under different conditions of cultivation : 1) an April fallow (that is, fallow ploughed in April) ; 2) a soil cleared several years since ; and 3) a 3 year-old lucerne soil. From each of these soils two layers were taken, namely the arable (from 0 to 17.7 cm. deep) and the layer immediately below (from 17.7 to 35.5 cm. depth). With the samples of soil mentioned 6 set of vessels were filled. The vessels of the first series, which were to serve as controls, were filled with the normal soil, that is to say neither sterilised nor chloroformed ; those of the second series, by

which it was proposed to determine the content of assimilable phosphoric acid, were filled with samples manured with potassium nitrate and magnesium sulphate ; and those of the third, which were for the purpose of ascertaining the content of assimilable nitrogen, contained samples manured with acid potassium phosphate (KH_2PO_4) and sulphate of magnesia; those of the fourth received a complete mineral manuring, that is to say: potassium nitrate, acid potassium phosphate and magnesium sulphate ; in the vessels of the fifth series the sterilised earth was put, and in those of the sixth the chloroformed earth.

The sterilisation of the soil was carried out in vessels placed in an autoclave where they were subject to sterilisation by steam for one hour at a pressure of 2.5 atmospheres.

After cooling, the specimens sterilised in this way were watered with sterilised water to the *optimum* point of humidity.

The chloroforming was carried out by placing the corresponding samples in bottles with ground stoppers and adding to each sample 50 cc. of chloroform. After they had been left for three days in the bottles the samples were taken out, and, when the chloroform had completely evaporated, were placed in the vessels. The vessels having been prepared in this way, oats were sown in them, after the seeds had been previously treated with an 0.2 % solution of formalin and washed with distilled water ; the seeds were then germinated in an incubator. In each vessel 8 seeds were put; after germination only the four most vigorous plants were left.

During the entire period of growth, the plants were watered with rain water to the *optimum* of humidity, the water being supplied from below by means of a special tube fitted to each vessel. The results of the experiments as regards the fertility of the tchernoziom in the 6 series of specimens studied are summarised in the accompanying table.

This table contains no particulars as to the effects of the sterilisation of the layer immediately below the arable layer (from 17.7 to 35.5 cm in depth) nor of the cleared land, or the lucerne soil, because on the sterilised samples of these soils the plants died in the course of their period of growth. The writer partly discerns the causes of this phenomenon in the fact that the sterilised soils, during the first few days, clearly exhibit a low capacity of water absorption, which proves that the sterilisation of the soil by means of steam produces not only biological but also physico-chemical changes. In order to obviate this drawback it is advised that the soil should be watered with distilled water to the optimum point of humidity for 6 or 7 days; if this precaution is taken the young plants suffer less. Passing on now to the general considerations emerging from the figures in the table, it is seen that the sterilisation of the tchernoziom brings with it a considerable increase in the production of the total vegetable mass, and that the effect of sterilisation, disregarding slight fluctuations one way or the other, is the same as that produced by complete mineral manuring.

As regards the chloroforming, it also brought about an increase in the total vegetable mass produced ; its effect nevertheless was less considerable as compared with sterilisation and complete mineral manuring. Wh

Fertility of Tchernoziom non-manured, manured, sterilised and chloroformed.

Manures applied and mode of treatment of the samples of tchernoziom	Average weight in gr. of the total vegetable mass (seed and straw)				Ratio between the vegetable masses, that of the control series being taken as the unit			
	on april fallow (layer from 0 to 17.7 cm)	on april fallow (layer from 17,7 to 35.5 cm)	on cleared land (layer from 0 to 17.7 cm)	on 3 years lucerne soil (layer from 0 to 17.7 cm)	on april fallow (layer from 0 to 17.7 cm)	on april fallow (layer from 17,7 to 35.7 cm)	on cleared land (layer from 0 to 17.7 cm)	on 3 years lucerne soil (layer from 0 to 17.7 cm)
1. Unmanured.	12.27	6.48	7.59	12.21	1.00	1.00	1.00	1.00
2. Nitrogenous manuring .	13.14	5.51	7.07	—	1.06	0.85	0.93	—
3. Phosphate » .	18.45	16.41	10.09	—	1.49	2.53	1.32	—
4. Complete mineral » .	33.64	33.60	27.09	28.15	2.74	5.18	3.56	2.33
5. Sterilisation	36.21	31.55	30.69	27.69	2.95	4.86	4.04	2.26
6. Chloroforming	21.08	22.39	—	—	1.71	3.45	—	—

re the causes of this increase in fertility? In order to reply to this question he writer carried out researches on the bacterial flora of the soils under tudy and determined the chemical composition of the sterilised samples, aying special account to two elements: phosphorus and nitrogen. Two ultures were made, one on agar, the other on gelatine; for each, peptonised eef bouillon, diluted to 0.001 in the one case and in the other to 0.0001, vas utilised as the nutrient liquid. The calculation of the number of bacteria was made in Petri dishes in reference to one gram of absolutely dry oil. These experiments were only made with April fallow tchernoziom

The results of these calculations, compiled in several tables, prove that the bacterial flora of chloroformed and sterilised tchernoziom is incomparably more numerous than the normal; that it is more numerous in the arable soil than in the layer below, and that in the case of sterilisation, it is more numerous on agar than on gelatine. For instance, for the normal samples of the arable layer in the culture on agar, with a dilution to 0.001, he number of bacteria before the experiments was 160 000 per one gram of bsolutely dry soil; after the experiments, 167 000, or an insignificant increase. In the soil chloroformed after the experiments the number of bacteria was 3 152 000 and in that sterilised it was 2 138 000. Considering he case of the chloroforming of the tchernoziom, and laying stress on the act that it creates conditions in the soil which lead to a more energetic multiplication of the bacteria, the writer believes that this action of the chloroform must be the principal cause which, in chloroformed soils, leads to he increased production of vegetable mass, because with the more intense evelopment of the bacterial flora those processes which enrich the soil in ertilising elements, especially nitrogen and phosphorus, also intervene ith greater intensity. The enrichment of the soil in this latter element phosphorus, takes place, according to the writer, at the expense of its organic

forms which are decomposed under the action of a highly numerous bacterial flora and give rise to the transformation of phosphorus from the non assimilable state into the assimilable state. On the other hand, the insoluble mineral phosphates pass into the soluble state, as was proved by STOKLASA, under the action of the carbonic, formic, butyric and acetic acids produced by the organic substances formed by the multiplication of the bacteria. With regard to the nitrogen, the increase in this element must be attributed to the fixation of atmospheric nitrogen by the bacteria, and to the organic substances of the soil.

Passing on to sterilisation, it is useful to note that the bacteria flora of sterilised tchernoziom exhibits one peculiar feature, namely, it develops much less readily on gelatine than on agar ; according to the analysis made by the writer, it is constituted by the microbes of the air, and therefore it cannot play an important part in the increase of the fertility of the soil. In order to study the cause of this increase the writer examined the quantity of phosphoric acid soluble in 2 % acetic acid contained in the sterilised and the non-sterilised soils, and he found that the sterilisation results in a substantial increase of soluble phosphoric acid ; in the arable strata the increase varies between 87.87 and 120.67 % and and in the strata lying beneath the arable layer, from 47.05 to 76.54 %. Among the sources contributing to the increase of phosphoric acid, the writer allots the first place to the nucleins, which contain 5.7 % of phosphorus and which, at the temperature of 150° C., decompose with liberation of phosphoric acid. The question of the nitrogen is not so clear as that of the phosphorus, because an equal quantity of it was observed both in the sterilised and in the unsterilised soils. It not being possible, however, to attribute an increase of fertility in the sterilised soils exclusively to the increase in soluble phosphoric acid, and taking into account at the same time the fact that by the sterilisation all the microbes were killed, and therefore it is not possible to assume the existence in the soil of the microbiological processes which result in the accumulation of assimilable nitrogen, the Author assumes here the influence of the decomposition of organic substances through the action of sterilisation.

The increase in the quantity of assimilable nitrogen in the sterilised soils was borne out by the fact that the plants, during the entire period of growth, were of a beautiful green colour even more intense than that of the sample which received complete mineral manuring.

The concrete outcome of the experiments is the following :

1) Researches into growth carried out on chloroformed samples of tchernoziom and supplemented by bacteriological and chemical investigations prove that the accumulation of the fertilising substances in the tchernoziom, which depends on the degree of vital intensity of the soil bacteria, does not, even under the best conditions of soil cultivation, supervene with the same intensity with which it might take place under other more favourable conditions.

2) Researches into growth, carried out in sterilised samples of the tchernoziom supplemented by bacteriological and chemical investigations,

nder it clearly evident that tchernoziom is sufficiently rich in crude ele-ents, both in the form of vegetable and animal residues and in other forms ith which, under conditions favourable to the process of disintegration and nthesis brought about by bacteria, a remarkable storage of the fertilis-le substances assimilable by plants may be created.

- **Study of the Nitrification of Different Leathers available for Agricultural Use, and Sulphurated Rape Cakes.** — GUILLIN (Director of the Laboratory of the Society of Agriculturists of France), in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. II, Year 1916, No. 27, pp. 760-769. Paris, 1916.

Crude tanned leather has long been regarded as a product which only ecomposes slowly in the soil. During the last few years another kind of ather, chrome leather, has appeared on the manure market. This leather, wing to its almost white colour (pale green), is rarely sold under the name f leather, but is marketed in the form of shavings. This chrome leather, f non-putrescent substance, may *a pri ri* be regarded as not subject to pid decomposition. Experiments were undertaken with the object of scertaining whether this view was correct.

The attempt has been made to render the leathers more easily decom-osable in the soil by various processes. The most usual of these processes roasting; roasted leathers are in almost all cases rendered slightly acid y the addition of a small quantity of sulphuric acid, but this quantity is ltogether insufficient to render their decomposition in the soil easier. Be-ides this, some manufacturers have sought to transform leather completely y dissolving it in sulphuric acid, afterwards saturating the excess of cid so as to obtain a manure in powder form put on the market under ifferent names: azotine, nitrogene, etc. Two of these dissolved leathers ere studied by the writer: for one, sulphuric acid was used in such a uantity as to convert the leather waste into a pasty mass. For the other, he quantity of acid used was greater and the mass was liquefied. The study elated, in brief, to the comparative nitrification of tanned leather, chrome eather, roasted leather and leather dissolved in sulphuric acid in a paste nd in liquid form, as well as the nitrification of sulphurated rape cake. ried blood was taken as a standard of comparison.

Composition of the Manures studied. - The composition of the manures udied is shown by the following table:

	Total nitrogen	Soluble organic nitrogen	Ammoniacal nitrogen
ried blood	11.72 %	0.63 %	0.26 %
anned leather	8.15	0.25	nil
hrome leather	8.87	0.11	nil
oasted leather	6.77	0.17	nil
issolved leather (paste)	6.03	2.33	0.25
issolved leather (liquid)	7.30	2.81	1.18
ulphurated rape cake	5.02	0.01	nil

Mode of Procedure. — The nitrification experiments were carried out ith clayey-lime soil of the basin of Paris (Gournay, Seine-et-Oise); this

earth, which contained 0.115 gr. of nitric acid per kg., was rendered thoroughly homogeneous, then brought up to a moisture percentage of about 20 %, after which lots of one kilogram were taken from it. The different manures having been reduced to an exceedingly fine powder, a weight of each of them corresponding to 1 gr. of nitrogen was weighed off; each of these weighed quantities was thoroughly mixed with 1 kg. of earth. For each manure, three different preparations were made, in order to be able to ascertain the quantity of nitric acid formed, after different periods of experimentation. The nitric acid contained in the mixture of soil and manure was also determined after 1,2 and 5 months' contact. By way of control the same was done with 3 lots of one kg. of earth to which no manure had been added, and the following results were reached:

Nitric acid contained in one kilogram of earth.

	After 1 month	Two months	Five months
Soil without manure	0.145 gr.	0.160 gr.	0.326 gr.
Dried blood	1.080	1.350	2.133
Tanned leather	0.166	0.190	0.404
Chrome leather	0.003	0.021	0.227
Roasted leather	0.220	0.265	0.523
Dissolved leather (pasty)	0.742	0.952	1.347
Dissolved leather (liquid)	0.990	1.200	2.015
Sulphurated rape cake	0.888	1.287	2.291

One of the results appeared to be altogether abnormal, namely that given by the mixture of 1 kg. of earth with about 11 gr. of chrome leather: not only was there no nitrification, but, a far more surprising fact, the pre-existing nitrate disappeared. This rapid distruction of the nitrates was so complete as to surprise the writer, who wondered whether the loss of the nitric acid during the course of its determination, was owing to the presence of chrome in the exhausting liquid. He therefore deemed it desirable at the same time to carry out a chemical control of his method of estimation and also an agricultural control.

Chemical Control. — In order to ascertain the proportion of nitric acid the procedure adopted was as follows: when the mixtures of earth and manure had been undergoing nitrification for the required time, they were placed in a 2-litre flask, 500 cc. of water added and the flask rotated on the SCHLOESING car. After a quarter of an hour the earth and water were completely mixed, and the nitrates were dissolved in the surface liquid; the liquid was drawn off into a large glass, the soil was allowed to settle and the surplus liquid filtered. 250 cc. of water were poured into the earth, which was shaken up and filtered after settling. This washing by decanting was once more repeated, after which the liquid and the mud were conveyed into the filter, and the latter washed after completion of draining off. In this way there were obtained the nitrates contained in the soil in a clear but very but dilute solution, which it is necessary to concentrate in order to determine the quantity by the SCHLOESING method

; nitrate must have been lost in the course of this concentration and ermination.

For the purpose of checking this loss, if any, the writer, with a soil erent from that previously used, made two mixtures with one kilogram arth with chrome leather under the conditions described. These two tures were kept for forty days in two vessels; at the same time, and ler the same external conditions, a kilogram of earth was studied by way ontrol. After 40 days, when the three lots were exhausted on the me- l used in the preceding experiments, the two liquids resulting from the austion of the mixture of earth and chrome leather were combined, ed and divided into two equal volumes. In one, after concentration, percentage was measured direct; to the other there was added a quantity itrate containing 0.150 gr. of nitric acid, it was then condensed and contents measured. The results arrived at were as follows:

Nitric Acid per Kilogram of Earth.

Existing in the soil at the start of the experiment	0.093 gr.
Contained in the soil forty days later	0.110
Contained in the mixture of soil and chrome leather	0.003
Found after the addition of 0.150 of nitric acid to the exhausting liquid	0.155

The method of measuring the contents of nitric acid therefore plays no t in the results found.

Agricultural Control. — 3 pots of equal size were used, each capable ontaining about 15 kg. of earth; into one, earth was put without manure, the second, earth mixed with chrome leather, and into the third earth ed with dissolved leather. In each pot 25 grains of wheat were sown the 16th April. These germinated normally on the 21st April. In the y days of May the young wheat stalks differed clearly; the plants grow- in the pot containing earth mixed with chrome leather were of very poor lity, the leaves being yellowish in colour, while the plants in the other s were strong, and the leaves were a fine dark green, particularly in the containing earth mixed with dissolved leather. The plants were weighed the 1st July. Taking the weight of the crop in the vessel to which no ther was added as 100, the weight of the three crops will be represented the following figures:

Earth without manure	100
Earth with chrome leather	30
Earth with dissolved leather.	115

Interpretation of the Results and Conclusions. — Chrome leather is inju- s to vegetation, and should therefore not be be regarded as a manure. chromium sesquioxide contained in this leather becomes hyperoxidised ie soil, destroying the nitrates, and after five months' contact the decom- tion of the leather is so small that the earth with which it has been in- orated contains less nitrate than earth to which no manure has been ed.

Farmers should not use tanned leather, which is of no fertilising va
nor roasted leather, the farm value of which is much below the commerc
value. These manures, even under the conditions of the experiment, wh
were exceedingly favourable to nitrification, only gave the following qu
ties of nitric acid per gr. of nitrogen contained:

	In one month	Two months	Five
Ground tanned leather	0.021 gr.	0.030 gr.	0.0
Ground roasted leather	0.075	0.105	0.1

On the other hand, leathers dissolved in sulphuric acid showed a
siderable nitrification, and they may be used to advantage by farm
but even here, in order to obtain the maximum effect with these prod
the treatment with sulphuric acid must be very active, and must not l
behind any non-disintegrated fragments of leather.

962 – **Catalytic Manures: Manganese as a Catalyser of the Biochemical Reac
by means of which Plants Assimilate Atmospheric Nitrogen through Bact
Agency.** – DE GREGORIO ROCASOLANO ANTONIO, in *Revista de la Real Academia de Ci
exactas, fisicas y naturales de Madrid*, Vol. XIV, No. 10, pp. 681-693, 3 diagrams. Ma
April 1916.

Experiments carried out starting from the hypothesis that any ca
capable of exciting the biochemical activity of the nitrogen-fixing organi
contained in the soil will have the effect of increasing the quantity of at
spheric nitrogen fixed in the soil or in the plant, and consequently of incre
ing the crop. There were used for these experiments pure cultures of *
cillus radicicola* isolated from the root nodules of red clover cultures
Clostridium Pasteurianum and *Azotobacter chroococcum* isolated from a c
tivated soil.

Quantities of 100 cc. of culture bouillon (to which mannite had b
added and which contained a known percentage of nitrogen) were pla
in ERLENMEYER flasks, and inoculated with pure cultures of *B. radicicola*. O
flask was used as control. To the 7 others increasing amounts of a gra
solution of manganese chloride were added. The flasks were incuba
for 25 days at a temperature of 22-23° C. and afterwards sterilised. Fin
the total quantity of nitrogen in the contents was determined by the KJ
DAHL method. The experiment was repeated in several series. The
sults show that *B. radicicola* fixes atmospheric nitrogen even in the abse
of manganese, but the manganese modifies the rapidity of reaction, tha
to say it is a catalyser of the biochemical reaction; it accelerates the la
in increasing proportions up to the optimum quantity which is 0.006 gr.
manganese ion per 100 cc. of bouillon. With this amount the quantity
nitrogen fixed was about three times that of the control. With doses
manganese in excess of the optimum, the acceleration falls off stabler
then (at 0.020 gr. %) the action changes into one of retardation.
experiments with *Clostridium Pasteurianum* were conducted in the s
way as those described above. The manganese is of great importanc
this micro-organism, as it was found that in the absence of this elemen

not fix atmospheric nitrogen. In its presence it fixes nitrogen in eciable quantities. The optimum degree of concentration of the lyser is the same as for *B. radicicola* (0.0041 gr. of nitrogen per 100 f culture bouillon were fixed with this amount); in concentrations er than the optimum, the acceleration is diminished and finally mes negative.

The experiments with *Azotobacter chroococcum* yielded results similar he preceding ones. This bacterium likewise only fixes atmospheric gen in the presence of manganese; the optimum concentration of manganese ion is about the same.

The practical conclusion is that fertilisers containing manganese in- se the crop, if applied in quantities furnishing up to 0.006 gr. of man- se ion per 100 gr. of soil. They reduce it if administered in quantities xcess of this. The majority of soil contain quantities of manganese in ss of the above optimum, but the bulk of this manganese is in insoluble n. In order to calculate the quantity of manganese salt to be put n as manure, therefore, it is first necessary to ascertain the quantity luble manganese contained in the soil and add only the difference.

AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS.

- Successful Treatment with Insecticides of Plants in Flower. — SHREIBER A. F., in *Труды Бюро по прикладной Ботанике* (*Bulletin of Applied Botany*), IXth Year, No. 4 (89), pp. 174-175. Petrograd, April 1916.

After referring to the experiments by Prof. S. GLASENAP, on the success- reatment with tobacco juice of apple trees in flower (1), the writer gives results of his own experiments at Irkutsk (Siberia) on an experimental for the cultivation of medicinal plants.

The experiments were carried out on *Calendula officinalis* L. which is liable to the attack of the larvae of *Mamestra brassicae*, these latter ouring the leaves. One part of the plants in the field was sprayed with te extract of aloes and the other part with a solution of extract of *Vera- n album*. Two successive sprayings were made which killed off all the ae. This treatment did not reduce the crop of seeds, and the plants ered in this way when in flower all yielded ripe seeds.

- Osmotic Pressure of Soil Moisture and Glassiness of the Grain of "Bielotourka" Wheat. (From the Works of the Laboratory and Growing Shed of the Scientific Agricul- ural Station of Bezentchouk, Province of Samara, Russia). — TOULAIKOV N., in *Изве- стія Опытной Агрономіи* (*Review of Experimental Agriculture*), Vol. XVII, Book I, pp. 79-91. Petrograd, 1916.

Great fluctuations in the price of hard wheat, which took place on one the same day at the Exchange of Samara, attracted the attention of Station, which, from 1913 onwards, organised a series of experiments on glassiness of the grain of the "Bielotourka" hard wheat, thus continu- work on the relations between the osmotic pressure of the soil moisture l the growth of the wheat in question (2).

(1) See *Bulletin de Botanique appliquée*, Vol. VI, No. 4, pp. 243-247; Petrograd, 1913. (*Ed.*)

(2) See *B.* 1914, No. 980. (*Ed.*)

In 1913 it was noticed for the first time in the laboratory that in "Bi lotourka" wheat cropped from the same pot some grains were found wi glassy fracture and others with floury fracture, and that the number of flou grains was greater in the pots with greatest soil humidity.

In 1914 and 1915 experiments were carried out in order to study th distribution of the floury grains in the ear, as it was at first assumed tha the presence of these grains in the wheat car of "Bielotourka" was a de fect which must have occurred in the grains of the upper part of the ear, th said grains being incompletely ripe or developing under abnormal condi tions. The result of the experiments carried out with great care was how ever negative, that is to say, it was not possible to detect any relation be tween the location of the grain on the ear and the character of its fractur

In 1915 experiments with pure lines of "Bielotourka" were made, th humidity of the soil in the pots being maintained at 50, 60, 70, 80 and 90 % complete saturation, or approximately at 20, 24, 28, 32 and 36 % of i weight when completely dry. The experiments demonstrated that whi with 20 % of moisture in the soil all grains have a glassy fracture, with a increase above this percentage the grains with more or less clear flour fracture appear, and in the pot with 35 % of moisture in the soil the grain with glassy fracture form only 10.8 % of the total crop. Thus the glass ness or floury fracture of the grain of "Bielotourka" wheat, even withi the limits of a pure line, does not represent a constant character, but th fracture may be modified under the influence of external factors intervenir in the course of growth, and, in the particular case under study, under th influence of the degree of moisture of the soil.

In order to investigate the influence of osmotic pressure on the chara ter of the "Bielotourka" grain, experiments were made in the greenhouse effect of changes in the osmotic pressure were studied by adding to the s the necessary quantity of the following salts: chloride, sulphate and nitra of sodium, ammonium sulphate, ammonium nitrate. The appended tab brings out clearly the relation between the osmotic pressure (determin in this particular case by the addition of sulphate of soda), and the natu of the grain of "Bielotourka".

Evidently therefore the quantity of grains with glassy fracture i creases with the rise of the osmotic pressure in the soil moisture, and at t pressure of 7 atmospheres all grains had become glassy.

It follows from a comparison of the data relating to the other sa experimented on, that their action is not equal; nevertheless, by gradua increasing the osmotic pressure of the soil solution a greater quantity glassy grains is obtained, and at a given pressure for each salt, all the gra become glassy. Thus by modifying the pressure of the salt salution it possible to obtain glassy or floury grains at will with "Bielotourka" whe The following fact was also clearly brought out: sodium salts exert a diff ent action of the formation of the glassy grain, according to their acid ra cles. Sulphate of sodium exerts the feeblest action; chlorine acts more e nitrate of soda still more strongly; with the addition of this last salt i sufficient quantity to raise the osmotic pressure to 2 atmospheres, alm

Osmotic Pressure of the Soil Solution and Character of the Grain of "Bielotourka" Wheat.

Osmotic pressure in atmospheres	Percentage of total crop exhibiting a:		
	floury fracture	glassy-floury fracture	glassy fracture
0.5	27.8	70.0	2.2
1.0	8.3	88.5	3.2
1.5	3.6	83.0	13.4
2.0	3.3	76.8	19.9
3.0	2.2	65.6	32.2
5.0	1.7	48.0	50.3
7.0	nil	nil	100.0

e whole of the grain becomes glassy, while with sodium chloride and so-um sulphate at the same osmotic pressure only 20 % of glassy grains are oduced.

The presence of nitrogen in the basic or acid radicle of a salt reacts the quantity of glassy grains in the crop: for all ammoniacal salts, as kewise for sodium nitrate, even at low osmotic pressures (1.5-2.0) the whole the grain is glassy. Thus, between glassiness of the grain and the pre-nce in the soil of a quantity of nitrogen in excess of that found there, nor-ally a very clear connection exists, *viz*: the increase of nitrogen in the utrient medium entails an increase in the quantity of grain with glassy acture.

With a view to better studying the glassiness of the grain, the Station 1913 made an analysis of this grain as to its total nitrogen content; the Bielotourka" grain was taken from a single pot in which the humidity f the soil had been maintained at 24 % of its total weight in the absolutely y state; this grain was divided into three groups according to the charac-r of the fracture.

The following results were obtained: the glassy grain represented about 0 % of the total quantity, and contained 2.02 % of nitrogen; the glassy-loury grain formed 38.3 % and contained 1.80 % of nitrogen, and finally he floury grain formed 41.7 % and contained 1,62 % of nitrogen; it fol-ows that the glassy grain contains a larger quantity of nitrogen than the loury grain. Similar investigations were made into the soft wheat grain Poltavka", produced under conditions identical with those of "Biclo-ourka" the glassy grain of the soft wheat contained 2.08 % of nitrogen nd the floury 1.83 %.

The quantity of nitrogen in the glassy grain increases with the increase f the osmotic pressure of the soil moisture determined both by nutrient nd non-nutrient salts, and with the increase in the percentage of glassy

grains. Equal percentages of nitrogen content correspond to equal percentages of glassy grains. Thus, according to the experiments in 1915, with sodium sulphate, sodium nitrate and ammonium nitrate, for the first two salts, at 32-38 % of glassiness of the grains, the content of nitrogen is nearly the same, fluctuating about the figure of 2 % (2.40-1.969 %). When the glassiness reached 100 %, an almost uniform percentage of nitrogen is obtained with all the salts, near 2.8 % (2.711-2.907 %).

The fact emphasised by the Author in his diagrams should be noted, that in the grain, even when the whole of it has become vitreous, the content of nitrogen continues to grow with the increase of the osmotic pressure according to the rule formulated herewith.

It is therefore concluded that the glassiness of the grain is not the factor on which the total content of nitrogen of the wheat grain depends, but that this latter property, as likewise the glassiness, depends, under certain external conditions of growth, on a more general cause, namely the osmotic pressure of the soil moisture and the quantity of soluble nitrogen contained in the soil. For instance, it may be assumed that the increase in the osmotic pressure causing a rise in the nitrogen contained in the grain of "Bielotourka" wheat, also produces an increased degree of glassiness of the grain. The influence of the degree of moisture of the soil may be explained by the fact that a greater humidity of the soil means a weaker concentration of the solutions and a lower osmotic pressure of the soil solution.

965 - **Senile Changes in the Leaves of *Vitis vulpina* L., and certain other Plants.** — BENEDICT HARRIS M., in *Cornell University, Agricultural Experiment Station of the College of Agriculture*, Memorandum No. 7, pp. 275-370, tables 50 + 52-58 fig. Ithaca, New York, June 1915.

An examination of the observations of modifications resulting from senility in perennial plants indicates that in this direction no investigations have been carried out on the lines of those undertaken in the animal kingdom. Observations on the effects of age in plants represent occasional records rather than investigations. The reason of this appears to be the tacitly accepted belief that since new leaves, stalks and roots are constantly formed from persistent embryonic cells, senility, as it occurs in animals must not be considered in relation to plants, and that this term, when used of plants, merely means that the conditions have become so unfavourable that parts in process of growth are killed. This view was encouraged by the very advanced age attained by some trees. The importance, however of determining whether or not senile modifications occur in plants, lies not only in the scientific interest of this determination but also in its reaction on the vexed question relating to the effects of the continuous vegetative propagation of seed-producing plants.

For his investigations the writer adopted *Vitis vulpina* L., a plant remarkable for the extreme vigour with which it puts forth a new growth every year, in order to reduce to the lowest possible minimum the likelihood of unfavourable conditions other than old age. He therefore carefully sought out, in the vicinity of Ithaca, New York, and Cincinnati, Ohio, vines of different ages growing near to each other under the most similar possible ex

rnal conditions. He was able to find 20 pairs of vines answering to these nditions, each pair consisting of a young and old vine. From each vine took 10 healthy, normal leaves which had reached full development, and examined the venation of these leaves. In this examination he took into count the following principles previously established either by other obrvers or himself: the islets, bounded by ribs, are of a constant size in the fferent parts of the leaf; they are of the same size in leaves of different size thickness taken from one and the same plant; furthermore, in leaves of e and the same vine having a different solar exposure, the exposure has influence on the surface of the islets.

In vines of different ages, however, the surface of the islets varies great-, being much larger in the youngest vines: the variation ranges from 3154 sq. mm. in a 3 year old vine to 0.1376 sq. mm. in a 70 year old vine. is difference cannot be attributed to anything but old age, the effect of ich is to give rise to a denser growth of the vein system, with a reduction the islets bounded by the ribs. From this a method is deduced for de-rmining the age of *Vitis vulpina* by mere examination of the venation and e following table is given for that purpose:

No of veinlets intersecting a 2 cm. line	Corresponding Age of the Vine
30 to 35	5 years or less
35 to 45	5 to 15 years
45 to 50	15 to 35 years
50 to 75	35 years and more

He verified the conclusions to which he had been led from examina-n of the leaves of *V. vulpina* by checking with other plants: *Vitis bico-*, Le Conte, *Tecoma radicans* L., *Salix nigra* March, *Castanea dentata* Bork, *ercus alba* L., *Tilia americana* L., *Ulmus americana* L., *Carya alba* Koch, *rya ovata* Koch, *Acer saccharinum* L., *Acer saccharum* Marsh, *Quercus dina* Lam., *Platanus occidentalis* L., and *Fraxinus americana* L. These nts all allowed of the same observations as to the influence of age with gard to the venation.

If age affects the meristematic tissues of seed-producing plants, the lls of the scions used for propagating certain varieties must be equally fected. The writer having considered this hypothesis verified it by his servations: plants produced by grafting are, as regards the leaves, of e age of the plant which furnished the scion, this age being reckoned om the time of production of the parent plant from seed; grafting and owth on the host do not renovate the youth of the tissues of the scion.

These conclusions are next discussed, and the causes to which the seni-y of leaves is to be attributed are sought for. The insufficiency of convey-ce of nutrient liquids by the vessels of plants which have grown old is dismissed. The possibility of the production of toxins is an attractive pothesis, but there is no direct and evident proof of their existence, and is hypothesis must be abandoned, because senility persists in cuttings parated from the old plant. It is therefore suggested that the visible

variation in the network of veins on the leaves is a progressive modification in the cells of the meristem and the leaf inherent in the nature of their protoplasm, this progressive variation being called senility in regard to animal protoplasm; the increase of the vascular tissue of the leaf with age furthermore constitutes a degeneration as regards physiological activity.

In order to establish this latter point the writer compared the photosynthetic activity of leaves belonging to old or young trees respectively. He made use of a method of approximation consisting in determining the gain of weight in one day of fragments of leaf equally exposed to sunlight. The determinations, carried out in August, gave the following general results as regards *Vitis vulpina*:

Average gain for leaves of 5 to 8 year old vines	9.4 % by weight
Average gain for leaves of 20 to 25 year old vines	1.4 % " "

He likewise determined the rate of elimination of carbonic acid in leaves taken from *Vitis vulpina* at different ages, and obtained the total results exhibited by the following table:

Average age of the young vines utilised	7.3 years
Average age of the old vines utilised	25.4 years
Number of determinations made	92
Average duration of each determination	23.84 hours
Rate of elimination of carbonic acid for the young vines	0.0349 % per hour
Rate of elimination of carbonic acid for the old vines	0.0297 % per hour

He next started to determine the quantity of water absorbed by young and old vine leaves, reduced to fine powder, in order to have indications as to the capacity of living leaves to retain water. He observed first of all that acidity is higher in the powder of young leaves than in that of old leaves (in the former case an average of 2.2 cc. of a decinormal solution of potash is required to neutralise 0.2 g. of powder, against 1.5 cc. for old leaves); in order to get rid of the influence of this acidity, he neutralised the substances subjected to experiment and obtained the following results:

General average of water absorbed by the leaves of young vines	489.0 %
General average of water absorbed by the leaves of old vines	387.1 %

Finally, he looked for and found other signs of senility. Thus he observed the variations in the number of stomata in *Vitis vulpina* of different ages.

Number of stomata in 1 *sq. mm., average for vines of*:

5 to 7 years	117
8 to 10 years	129
20 to 30 years	282

He next proposed to determine the size of these stomata, and reached the following results:

Average longitudinal diameter of the stomata.

Vines from 5 to 7 years	16.6 μ
Vine from 20 to 30 years	10.8 μ

Similar results were also obtained by the measurement of the cells of the palisade layer in the leaves (12.2 μ in the 5 year old vines as against 10.3 μ in those of 20 year old vines) and by determining the ratio between the cytoplasm and the nucleus (this ratio being 388 to 1 in the vines aged from 5 to 7 years, as against 478 to 1 in those of 20 to 30 years) ; nevertheless this latter determination does not present all the necessary conditions of accuracy.

The writer next draws conclusions from these observations, and in particular envisages their application to the question of the degeneration of plants reproduced by scions or slips ; he lays stress on the interest attaching to investigations on this important question. Finally he examines and generalises the theories of senility, in order to extend them both to the animal and vegetable kingdom. He rejects the theories relating to the localisation of senile modifications, including the theory of METCHNIKOFF on the part played by toxins secreted in the main intestine of animals and in the flower of plants. He likewise does not admit that old age is due to the accumulation of katabolic products, or to the decreasing elimination from the body of the products of secretion of cells placed far away from the surface. To him, old age results from a physical or chemical degeneration involving the protoplasm itself, producing among other changes a diminution of permeability, and he concludes that the evidence appears very strong, both from the point of view of senility and that of regeneration, that the duration of life is directly bound up with the degree of permeability found in that part of the living cell which is in contact with the surrounding universe, and that in proportion as the activities of life continue, the cell is entombed by an inexorable diminution in the permeability of its protoplasm. The fundamental cause of this diminution may very well be the colloidal nature of protoplasm. The relatively simple relations existing in non-living complex colloidal bodies tend to be modified under the action of external forces, or even by the mere action of time ; it seems inevitable that the extremely complex colloidal states which form protoplasm should be modified progressively by the activities of life and by the intervention of external forces. What should give rise to astonishment is not the senile modifications of the protoplasm, but their tardiness in appearing.

Regeneration is the process by which the original arrangement of the colloidal elements constituting the protoplasmic colloids is restored.

Sexual reproduction is one of the methods by which this regeneration is accomplished, while it is ensured by more primitive methods in asexual plants.

It is for the future to solve the question whether the progress of senility in sexed plants and animals can be arrested or even retarded by means of regeneration such as are utilised in asexual forms, and which are thus to a certain extent applicable to the whole of the somatic cells. The know-

ledge which we at present possess as to the cause of senile degeneration does not allow of a rash negation of the possibility of somatic regeneration.

In a bibliographical appendix the writer gives a list of 57 works.

966 - **Experiments in Siberia, on Different Varieties of Oats.** — (Communicated by the Establishment for Seed Production of Smoline L. D. and Skalosoubov N. L., situated near Kurgan, Government of Tobolsk, Siberia). — SKALOSOUBOV N. L., in *Сельское Хозяйство и Лесоводство* (*Agriculture and Sylviculture*), Year LXXVI, Vol. CCL, pp. 562-571. Petrograd, April 1916.

The experiments begun in 1913, chiefly with the object of elaborating and establishing the methods and technique of selection, were resumed in 1914, the original selected seeds being made use of wherever possible. The following varieties were experimented on: 1) " Rykhlik " oats of the Experimental Station of Sobiechine, coming from Siedlez, Poland (No. 809); 2) " Golden rain " from Svalof (No. 766); 3) Imchinsk oats, received from Tobolsk (No. 743); this variety was held in good repute 15 years ago; 4) beardless Probstei oats from Svalöf (No. 747); 5) " Victory " from Svalöf (No. 768); 6) " Ligovo II " from Svalöf (No. 768); 7) " Rykhlik " from Sobiechine, first growth of this variety on the farm (No. 553).

On the basis of the description of the varieties of oats given by KORNICKE, the writer states that among the 6 varieties experimented on, 4 were found to be homogeneous from the botanical point of view: the " Golden rain " may be referred to *Avena sativa patula* var. *aurea*, Keke; the Probstei beardless to the same variety; " Ligovo II " to the variety *A. sativa patula aristata* Keke; " Victory " to the variety *A. sativa patula* var. *praegravis* Kr.; the " Rykhlik " from Sobiechine appears to be a mixture of the three forms of *Avena sativa: patula* var. *trisperma* Schübler, *aristata* Kr., *praegravis* Kr., or of four forms, namely the 3 preceeding ones and in addition the variety *aurea* Keke; finally the Imchinsk oats are made up of three forms: *A. sativa patula: mutica* Al., *praegravis* Kr. and *aristata* Kr.

The experiments were made on plots of 109.25 sq. metres (0.01 dessiatine), each being repeated on 3 plots, taking as the standard of comparison the original " Rykhlik " variety from Sobiechine (No. 909). The oats followed potatoes on a sandy tchernoziom soil ploughed in autumn and spring before sowing.

In estimating the results the writer did not confine himself to the arithmetical mean of the crops, but also made allowance for the probable error; he also carried out researches into the more or less close stand of the culms, on tillering, earliness, on the variations in the weight of the glumes, and on the absolute weight of the grain. He thus found that from the point of view of yield the varieties " Rykhlik " from Sobiechine and the 3 Svalöf varieties, namely " Victory ", " Probstei " and " Golden rain ", stand out; from the point of view of earliness: the " Rykhlik " from Sobiechine and " Golden rain "; as regards weight of glumes " Probstei ", " Golden rain " and " Rykhlik " from Sobiechine are the most prominent, and as regards the absolute weight of the grain: " Rykhlik " from Sobiechine, " Victory " and " Probstei ", while " Golden rain " ranks last in respect of this

character, which renders it highly valuable for sowing because in order to sow a given surface a smaller quantity of small than of large grains will be needed.

The direction of variability of the varieties tested under the local conditions of Siberia is clearly brought into evidence by the table annexed, in which a comparison is made between the two characters: grain production and size of the seeds (the data for the Svalöf varieties are taken from the publications of the Svalöf Company).

This table shows that under the conditions ruling in 1914, which was a favourable year, all the Svalöf varieties with the exception of "Ligovo II" gave a better unit production in Siberia than in their country of origin, i. e. Southern Sweden. As regards the absolute weight of the grains, it diminished in the varieties "Golden rain" and "Probstei", while it increased in "Victory" and "Ligovo II"; but if account is taken of the fact that the Svalöf seeds were put on the market after very careful sorting out for size, while for the seeds grown in Siberia the sorting was reduced to getting rid of the stunted and light seeds by the Clayton and Reber apparatus, this difference becomes quite unimportant. The comparison between the numbers of grains contained in 21.33 gr. of the original product and in that obtained in Siberia renders the reduction in size of the Siberian-grown grains more strongly evident; this is explained by the fact that the Siberian grown grains were not sorted out with regard to weight and that the Svalöf seeds employed for sowing were, in respect of absolute weight, slightly above the averages published by the Svalof Station.

Variability of the Varieties of Oats when grown in Siberia

Varieties of Oats	Original productivity			Productivity in Siberia		
	Productivity per acre in cwt.	Absolute weight of 1 000 grains of oats gr.	Number of grains of oats in 21.33 gr.	Productivity per acre in cwt	Absolute weight of 1 000 grains of oats gr.	Number of grains of oats in 21.33 gr.
Rykhlik » from Sobiechine	—	—	550	—	—	616
«Golden rain»	26.87	28.6	623	27.23	27.5	753
Inchinsä oats	—	—	768	—	—	784
«Probstei»	26.64	32.4	533	28.07	32.3	641
«Victory»	27.05	32.0	513	29.86	32.8	626
«Ligovo»	26.4	35.1	503	24.47	37.5	554
"Rykhlik", grown on the farm itself	10.35	34.9	630	25.31	32.9	620

967 - **Work in Tobacco Selection at the Experimental Station of Djember, Residence of Besoeki, Java, from 1912 to 1915.** - SPRECHER ANDREAS, in *Mededeelingen van het Besoekisch Proefstation*, Nos. 6-9-12-15, 1914 and 1915.

I. — PLANT IMPROVEMENT WORK. — This was undertaken in 3 directions, namely:

(*A*) Choosing among the races hitherto grown in the country types which answer the purpose in view to the best possible degree ;

(*B*) Introducing new races capable of competing advantageously with the old races of the country ;

(*C*) Production of constant hybrids combining the favourable characters of yield of different old types.

The tobacco plantations in the East of Java differing greatly as regards altitude, exposure, temperature, rainfall, humidity of the air, wind, soil, etc., it is obvious that the same race cannot everywhere answer the requirements of planters. For this reason, at least 3 races have been under cultivation for a long time in the province of Besoeki, apart from the first crosses which well informed planters send in large quantities every year to the European market where they meet with promising success, and the races cultivated by the natives for their own account. The latter sometimes supply a cheap tobacco very much in demand for the Rotterdam and Amsterdam markets, and above all they furnish the requirements of the country.

In view of the different races under cultivation, the manifold objects to be attained and the unequal conditions of plantations, it was clearly essential to have experimental fields in different places. The tobacco planters in the East of Java quite clearly realise this ; the new experimental Station at Djember therefore now possesses 4 experimental fields occupying an aggregate of about 30 acres, owing to which arrangement an examination may be made, at different altitudes, under different atmospheric conditions, and on varying types of soil (although all of volcanic origin), either of the lines selected from the races of the country, or of the first or subsequent crosses obtained on a rational method, or again foreign varieties and races.

Though it is not practicable to obtain 2 good tobacco crops from the same field in one year, it is nevertheless possible, when there is a sufficiency of land available, to carry out 2 plantings, one during the rainy season (January-April), the other during the dry season (August-November). In this way, the Djember Station every year carried out 2 plantings, even 3, the dryest months (June-August) being chosen for Turkish tobacco.

Owing to its not being found advantageous to plant tobacco every year on the same soil, some planters rotate their cultivations as follows : after a rice crop in May tobacco is put down (August-November), then again rice (January to May), then maize, soya or some other leguminous crop is planted, then once more rice, and it is then the turn of tobacco again after 2 years. It is a great advantage to be able to alternate cultivations and the "sawahs" (paddy fields) are admirably adapted for growing tobacco in these tropical regions. The rivers which serve to irrigate the fields not only contribute a fair amount of fertilising silt, but besides this the water which remains on the fields for some time kills the many insects to be found in the soil, which insects might sometimes have disastrous effects in hot countries.

(A) *Choice of suitable Types.* — The selection of local races was begun with 120 parent plants, 55 being of the "Kedoe" race and the others

of the " Deli " and " Canarie " races. According to COMES, the 3 races are he result of crosses between the varieties *havaniensis* and *macrophylla purpurea*) (1). The " Deli " race is finer and in a favourable climate yields igar wrappers which are much in demand. The " Kedoe " race is not so ine, but is more aromatic and more vigorous, and does not require so much ttention as the " Deli " race. It also sometimes furnishes wrappers for igars of a less fine quality. The " Kedoe " plant presents some points of esemblance with one of the " Manilla " races, and that is alleged to be its rigin. The " Canarie " race will stand more drought and heavy soils. n the East of Java it does not yield as good a tobacco as the " Deli " and Kedoe " races, while in the Sultanates of Djokjakarta and Soerakarta, the middle of Java, it is the only one cultivated and supplies a tobacco f dull appearance for cigar wrappers.

All the parent plants chosen in the autumn of 1912 in the different plan- tions were analysed on the methods set out in Bulletin No. 9. The results f this large task, however, are only public in respect to the " Kedoe " race hich was the first to be studied. The analysis embraced the height of the lant, the number, shape, uniformity, venation and mutual position of the aves. The following points of the first 15 leaves, green and dry, were udied for each plant: length, width, area, ratio between length and width nd fineness, *i. e.* ratio between area and weight of leaves. Finally, for the ried leaves, the weight of the midrib was indicated, the ratio between the eight of the leaf and the rib, then the colour, determined by means of a ale of colours, and finally the burning qualities and the colour of the ash. this way average values were obtained and also coefficients as to correla- on which may serve as a standard of comparison for all subsequent studies relation to the " Kedoe " race.

There was found: an inverse correlation between the number of the stance apart of the leaves; a direct correlation between the number of e leaves and the ratio of their length and width; a third, direct, between the eight of the leaf and the weight of the midrib; a fourth, inverse, between the eight of the leaf and the ratio between length and width; a fifth, direct, etween length and width of the leaves and so on.

The methods hitherto adopted in laboratories in studying the combust- n of tobacco have no practical bearing, in the writer's opinion, but may n the other hand serve for comparison of the different races and lines. The neness of the tobacco, as well as its rapid and continuous combustion, de- end mainly (questions of race apart) on the ripeness of the leaves, and in e second place on the drying and fermentation of the tobacco. Leaves ch are too old and those which are too young exhibit the same faults: it of fineness and defective combustion. The reasons for these defects, ever, are not the same in the two categories. In over-ripe leaves there n excess of cellulose and woody substances; on the other hand, the over-

(1) The writer adopts in its entirety the system of tobacco classification of Italian writers. The species *Nicotiana Tabacum* is subdivided into varieties, the varieties into races, the into genotypes or pure lines and the lines into individuals.

young leaves contain too great a quantity of fats and albuminoids, which d not decompose to a sufficient degree during the fermentation of the tobacco

In leaves picked at the right time, the mineral salts and organic sub stances are present in favourable proportions. In this condition of the leaf the ferments in it are active, and it is these ferments which, during suitabl fermentation of the tobacco, are capable of effecting transformation o the starch, sugars, cellulose, fats and albuminoids.

Unfortunately, the study of the lines chosen among the native races could not be continued each year in as thorough a way as was reported in Bulletin No. 9. Thus, in Bulletins Nos. 12 and 18 the different types are judged from the practical point of view only. For some lines of the races "Deli" and "Kedoe", however, cultivated on two different fields, statistic al study was carried a little farther as regards the height of the plants, th number and distance apart of the leaves, and also the number of leaves up to 1 metre height of the stalk. The results of this analysis are, *inter alia* the following.

1) The field with more moisture and less sun, a less clayey an lighter soil, produced a greater length of stalk together with great distance apart and size of the leaves, while the other field with less moistur more sunshine, and a heavy and clayey soil, yielded more closely packe plants with more numerous and smaller leaves. The two races behav identically.

2) In both races, the lines with the greatest number of leaves up t 1 m. height are preferable from the quantitative and qualitative poin of view. The types with leaves a short distance apart generally posses a larger number of leaves than others in which the spaces are wider, and when there are small spaces the leaves follow each other more regularly on the stalk and afford better shade, so that when dry they exhibit a more homo geneous lighter and duller colour.

3) The seedlings chosen in the first place from the nurseries yiel a finer plantation than the second or third choice of seedlings. All other thing equal, backward seedlings will never yield in the open field tobacco plant as healthy and with as many leaves as strong seedlings. Seeds with feeb germs do not, even if the nurseries are manured, produce as strong adu plants as non-manured seedlings derived from strong embryos.

What is called the "Deli" race is a mixture of many genotypes. S veral of these types have been under cultivation for years in the east of Jav for instance the "Deli-Palembang", "Deli Toentoengan", "Deli Besoeki "Deli-Arensburg", etc. Even the "Deli-Medan", however, is compose of several types, and the writer regards the "Deli" race as more variab than the "Kedoe" race. Though the difference may not always be eas to detect in the field, it is obvious on comparing the dry tobacco, and the trouble is taken to mesure the plants it can be demonstrated mathemati ally. It is by measuring, counting and weighing certain properties the phenotypes which for several generations represent the different gen types, that a pure line may most effectively be distinguished from a popul tion of types.

(E) *Introduction of New Races.* — About a hundred foreign races were planted during the three years in the different fields of the Stations. The seeds were obtained both from the experimental tobacco Institute of Scafati (Italy), and from the Department of Agriculture in Tokio (Japan). Among these exotic races, there were forty from Japan, others from the Balkans and Asia Minor, others again from the W. Indies, North and South America, etc. The results obtained are not encouraging, but it must not be forgotten that a single trial cannot be deemed sufficient.

Some by the Japanese races are distinguished by a fine leaf and a light colour, for instance " Hatano " (which has already been used for some years by growers in Besoeki for the production of hybrids), " Shinde " and " Satsuma ".

Turkish tobaccos (tobaccos from the Balkan countries and Asia Minor) grow fairly well, but the moisture of the air, even during the dryest months, is too much, which results in the leaves growing too large, too fine, and without sufficient aroma to form a good cigarette tobacco. It has not been possible up to the present, in spite of every care in gathering, drying and fermenting, to preserve the golden yellow colour of the leaves which characterises some Turkish tobaccos ; the most serious defect, however, is their weak aroma. Among the races which stand out favourably from the point of view of colour, aroma and combustion, mention may be made of : " Yakamathi ", " Yaka-Cavalla ", " Aya Solouk " and " Samsoun ".

The North American races proved not to be sufficiently resistant to virus diseases ; those of Central America, the W. Indies and South America gave coarse tobaccos of a variegated and dark colour.

The " Bajesi " race of Hungary and another from Timor are distinguished by their vigour ; they find no difficulty in growing in poor soils and under unfavourable conditions of climate.

By continuous and persevering work foreign races presenting greater advantages might be found, but the writer, working on behalf of the planters, was anxious to obtain a practical result as speedily as possible.

c) *Production of Hybrids with fixed Characters.* — Numerous crosses were made with a view to improving both the quantity and the quality of the tobacco. By selecting from among the races of the country only, if they form populations comprising many lines, there is the likelihood of finding an advantageous type for cultivation. Once the pure line is obtained, however, any subsequent improvement could only relate to the methods of plantation manuring, cropping, drying and fermentation, as a pure line cannot be changed ; whilst by hybridisation there are obtained in the 2nd generation a multitude of forms, some of which combine the favourable characters of the parents, while others exhibit morphological or physiological, or again ecological characters which were by no means apparent in the parents. Seeing that planters expend fairly considerable sums every year for breeding experiments, it was clearly the duty of the experimental Station to look for types sufficiently constant for cultivation on a large scale. Judging from the results obtained, this is possible within three years, that is, after 6 generations.

II. — DISEASES AND PESTS. — It cannot be said that there are any really serious diseases of the tobacco plant in the East of Java :

There is some small amount of fungous disease (*Phytophthora Nicotianae*, *Bacillus Solanacearum* Erw. Sm., *Cercospora Nicotianae* Ell. and Evr., etc.), but it occurs quite sporadically. More dangerous are the numerous insects (*Heterodera*, *Gryllus*, *Gryllotalpa*, the larvae of *Plusia*, *Heliothis*, *Prodenia*, *Lita*, and *Opatrum*).

The larva of *Lita solanella*, particularly, produces galls in the young plants which prevent normal growth. A rather serious disease is the mysterious " mosaic disease " which chiefly attacks fine-leaved races. In spite of many studies, it is not yet known whether this is a fungus disease or results from defective assimilation. Such defective assimilation certainly occurs, but is it caused by bacteria or by the soil, moisture or heat ? This problem will no doubt be better solved by laboratory experiments in which the external conditions can be minutely regulated. In the open field there are many factors which escape investigation, in spite of the most estensive weather observations. The importance of the latter, however, cannot be over-estimated, above all in the study of tobacco, and it is a great advantage to the Station of Djember that it possesses a meteorological installation in the vicinity of one of the experimental fields.

III. — MUTATIONS. — The Author next deals with some rather interesting forms of mutation (or deemed to be such) :

There is for instance a form with a double flower, very pretty, with the outer corolla turned up, which has repeatedly been observed in Java. It is extremely rare, but breeds true in all its characters ; one double plant among the seed plants of a plantation is sufficient for it to reappear in the following generation, unless it is to be supposed that the same mutation can be repeated successively in different places. In Bulletin No. 12 a good reproduction of this very pretty flower is found.

Another variation is represented by the giant plants found in the Dutch East Indies among the races " Deli " and " Canarie ", but apparently not among the " Kedoe " race. Instead of forming a large inflorescence in panicle form after 3 months' growth, the top of the plant continues to grow, forming numerous small leaves in the axil of which there is sometimes, but rarely, a single flower. More frequent among the giants are the forms which reach great heights (16 feet and more) ; they mostly remain completely sterile or in some cases, after 8 months' growth, produce a few rare flowers. The writer found that these latter forms transmit their characters on a constant way, while other forms which do not always exhibit all the characters of the giant plants produce among their descendants 1, 15, 20, 21, 25, 31, 36, to 91 % of giant plants, according to various workers. Here the Author does not admit the term mutation, as he is of opinion that this term should not be applied unless the hereditary factors of the initial material have been examined thoroughly, which was not done with tobacco. The " Deli " race, for instance, seems to him to be made up of several special races transmitting their characters in a more or less constant way according to external circumstances.

Giant plants are explained by means of the theory of TSCHERMAK on association and dissociation of "cryptomerous factors". According to theory, the races which from time to time produce giant plants are as with dissociated cryptomerous inherited factors, that is to say that factors which transmit the height of the plants, the standard of size, number and distance apart of the leaves, the period of growth, etc., combined in such a way with the factors which transmit the abnormal ht, many leaves and a longer period of vegetation, that there is no action ie one class of factors on the other under ordinary conditions. The cha- ers of the giant plant being dissociated from those of the normal plant efore remain under these cryptomerous conditions, and a normal plant rned. If, however, owing to external circumstances the two catego- of factors come into contact, then in the progeny giant plants in greater sser number form according to the intimacy of this contact.

The property which produces the giant is therefore made up of several rs: slow growth, indefinite growth of the main axis (leader), poor in- scence, long period of vegetation, leaves much more numerous, less wide,

Each of these factors is presumed to be present in the normal plant, lissociated from the normal factors, for which reason they have no in- ce on each other. If a partial association occurs, a transitional form ts. For instance, if the factor for late flowering remains dissociated, the giant plant flowers like an ordinary plant; if the factor for slow th remains dissociated, the plant develops as rapidly as a normal ; if, finally, the factors of an indefinite growth and of a defective escence remain dissociated, there is only obtained a plant with many s of less width and smaller internodes, which for the rest, however, nt nothing abnormal. A perfect association therefore produces giant s exclusively, and a complete dissociation furnishes only ordinary s.

Following the example of R. THOMAS, BATESON, G. HOWARD and FRU- H, the writer also made experiments on parthenogenesis in tobacco. negative results which he got invalidate those of R. Thomas and Ba- and confirm those of G. Howard and Fruwirth (1).

All growers know how frequent are anomalies in the tobacco plant. writer found golden-yellow types and others which were variegated in degree; there is often fasciation of the stem and epiascidia and hypo- lia occur in the leaf.

Tobacco seeds kept in airtight bottles retain their germination capacity tropics for 7 years at least. Germination experiments undertaken idate the question whether the specific gravity affects the germina- pidity and capacity have shown that seeds which float in a solution of

(1) Continuining these investigations the writer has since obtained positive results. A Ja- race", Okinawa", with white flowers, shady leaves and very lengthy period of vegeta- duced fruits and seeds without pollination. The fruits are perfectly normal, but the ve not yet been studied. It this may not be a definite case of true parthenogenesis as e the seeds have well developed integument.

sugar of 12.5 % germinated better than those which sink in this solution. In the latter the seed covers appear to have increased in thickness and weight at the expense of the germ. Those which remained at the surface of the water germinated less than those of the others. (Bull. No. 12).

GRICULTURAL SEEDS

968 – **A new Method of Determining the Impurity of Cereal Grains, caused by the Presence of Seeds of *Agrostemma Githago*** (From the Work of the Seed-testing Station at Kharkov, Russia). — JANATA A., in *Южно-русская сельскохозяйственная Газета.* (The Agricultural Gazette of Southern Russia), XVIIth Year, No. pp. 6-8. Kharkov, December 1915.

Agrostemma Githago causes damage of two kinds: it infests the fields and its seeds, mingled with cereal grains, impart to the latter, and the flour manufactured from them, properties which are injurious both to men and animals; it is not yet definitely known what is the origin of this injurious action, but in spite of this, " under conditions in connection with army supplies ", the only conditions recognised by law in Russia, and which serve as a basis for the purchase of cereals, it is provided that the seeds of *A. Githago* may not exceed 0.06 % in weight.

In view of this low percentage, very delicate scales are required to determine it by weight, and also practice in handling them, which form a serious obstacle to the enforcement of the regulations. With a view to devising an easier and more practical method, experiments were carried out on oats, barley, rye and wheat grains from both small and large farms in 11 districts of the government of Karkov, in order to determine the average weight of the seeds of *A. Githago*, with the object of using the weight so determined in ascertaining the degree of impurity of the grains.

The results of the experiments were as follows :

The total number of seeds of *A. Githago* weighed was 1 820, and the average weight of one seed was 0.0101 grms., but the weight of each seed fluctuated between 0.0128 grms. and 0.0056 grms.

No relation was observed between the weight of the seed of *A. Githago* and the description of cereal or the locality from which it had been taken.

On the other hand, the influence of another factor, the class of the farm, appears to affect the weight of the seeds of *A. Githago*. This rate is rather higher for big farms than for small ones. Considering, however, that the difference is very small and does not exceed the limits of fluctuation in the weight of seeds coming from each of the different classes of farm, the writer takes the view that in practice the average weight of a seed of *A. Githago* may be assumed to be equal to 0.01 grms. for all farms.

Taking this average weight as the basis, it is easy to pass from the number of seeds of *A. Githago* in 100 grms. of grains, to their percentage by weight. If, however, the legal percentage of impurity mentioned above is considered, it is easily seen that in 100 grms. of grains, the number of seeds of *A. Githago* should not exceed 6. The introduction of the numerical method will greatly facilitate the technique of testing the purity of the grain as regards its content in seeds of *A. Githago*. This method would also be of use in connection measures against this weed.

Possibly subsequent researches may, on various grounds, mo

average weight found, but according to the writer they cannot invali-
e the rational character of the numerical method which he has proposed
practical objects.

- **Liquid Manure with Addition of Sulphuric Acid as Spring Manure and Means of Control against Weeds and Lodging of Wheat. Sulphur treatment against the Parasites of Lodged Wheat.** — GIGLIOLI ITALO, in *Bollettino della Società degli Agricoltori Italiani*, Year XXI, No. 9, pp. 257-266. Rome, May 15, 1916.

As early as 1872, LUDWIG KOCK demonstrated experimentally that pre-
osition to lodging in cereals must be attributed to insufficiency of light
ing the first few months of growth of the plant, which insufficiency
kens or entirely interrupts the chlorophyll function, besides promot-
an accumulation of water in the culms and leaves, which leads to the
id lengthening of the weakened plant. The result of this is an exuber-
growth of the wheat. In the first period of development the growth
he wheat is very dense ; the weeds, which thrive under the shade of the
at, belong to those species which are adapted to requiring the least
ntity of sunlight and which, forcing their roots downwards in the soil
e rapidly than wheat, thus find conditions favourable to their develop-
it, which still further increases the shortage of light from which the wheat
ers. Moreover, overcast weather, the crowding of the wheat stalks, the
t of light and the humidity due to the weeds which cannot be success-
y extirpated, favour the growth of parasitic fungi which attack and
ken the watery and soft culms of the wheat at their base.

The conditions in the spring of 1916 were such (wet season with fre-
nt wind, sky often overcast and unsteady weather) that lodging of the
at was apprehended, and the writer therefore desired to ascertain the
es of this phenomenon, and on the basis of his own experiments and the
lts of the chemical method for controlling the weeds which infest wheat,
lso desired to suggest suitable remedies against lodging.

Farmers in general blame fertility of the soil and excess of manure for
noderate growth of the wheat with consequent lodging, but the Author
rts that it is not the natural or artificial fertility of the soil which direct-
leads to the lodging of wheat, as he frequently found, for several years
succession, on the experimental field of Suessola (though this field is
ndantly and even excessively manured), that wheat never lodged near
edges of the many plots (these were 123), where the plants had a better
osure to the sun, while they were all lodged in the centre of the plot where
vegetation was too crowded. Similar observations, to the effect, na-
ly, that an abundance of nitrogenous manure in the soil does not always
duce lodging of grain crops, were made a number of years ago by T. POGGI
Polesina. It follows that in wheat growing the farmer need not be too
h concerned at an abundance of manure, provided he prevents the young
its undergoing a rapid and crowded growth which would directly de-
e them of light, and takes care to destroy the growth of weeds in good
e. The first object may be secured by all such measures as ensure the
ng wheat the best of all « fertilisers », namely sunlight. With this ob-
in view, the sowing should not be too close or too early, especially if

the soil is very fertile owing to recent manuring of immediately preced crops intended to enhance its fertility. Sowing should not be do closely and broadcast, but rather in rows or ridges, which increa the light available for the wheat, and also allows of proper weeding and sup ficial tillage at the beginning of spring, so that between the rows the s remains perfectly clean and under favourable conditions of aeration. T very old practice of topping wheat when too high, or feeding it to sh for a short space of time, is a method by which the lower part of the cul may be made to benefit by the reinvigorating and wholesome effect of s light.

With regard to the destruction of weeds in good time, in considerat of the results obtained in France, England and Scotland by spray the wheat (with sulphate of copper, or, according to M. RABATÉ, v dilute sulphuric acid) as a direct method of weed prevention, and the basis of the experiments carried out by himself in the experimental f of Suessola with human urine to which sulphuric acid had been added, use a nitrogenous manure, the writer proposes to modify the RABATÉ metho spraying wheat with dilute sulphuric acid, and to combine the treatm for weed control and the destruction of parasitic fungi with the spring trogenous manuring. This treatment would be carried out with u acidified by sulphuric acid, which should be put down as a cover on the wh in the spring, and repeated several times if possible, by means of spray as is at present done with sulphate of copper and the ordinary dilute so tion of sulphuric acid.

The only economic method of conserving urine is based on mineral sal The writer has always stressed the importance of agricultural utilisati of human and animal urine, pointing out that urine contains a quantity nitrogen five times greater (4.40 kg. as against 0.80 kg.) than that existi in solid excrement. He adds that at the present time almost the wh of this urine is wasted, and that in Italy the annual loss may be estima at 300 million francs.

Passing on to deal with his experiments in manuring with human ur plus sulphuric acid, which were carried out at Suessola, the writer sta that this manure was applied with success during the 18 years of continu cereal growing, two grain crops being taken each year, maize follow wheat in the same year. In the course of the successive years, variable quan ties of acidified urine were employed, the most usual proportions be 320,249,223 and 178 gallons per acre. The acid solution was in some ye applied in the autumn before the wheat was sown, but in most instan it was spread in the spring. The leaves of the wheat were slightly bu by the drops of caustic liquid, but the wheat rapidly recovered and gav fine yield.

Taking into account the experiments conducted of late years on beneficial action of sulphur, particularly in respect to organic soils and dif ent cereal crops on the one hand, and the fungicidal action of product on the other hand, the writer, in case of vigorous growth of fun parasites on wheat during the ripening period, advises the sulphuring

he young wheat with the object of preventing and combating this danger, nd at the same time contributing to the soil a substance capable of produc- ıg a fertilising action for subsequent crops. Probably the useful action f sulphur in the soil is an indirect one, in which the sulphur, by modifying ıe microflora and microfauna of the soil, renders the latter more fertile.

As a result of these considerations, the writer proposed to the "Società egli Agricoltori italiani" in Rome to organise co-operative experiments ı the spring of 1916, on plots of 50, 120 or 240 sq. yds., chosen in the wheat elds where there is most reason to apprehend lodging and its consequences, ı order that farmers might form an exact opinion about the measures pro- osed for the prevention and mitigation of the injuries due to lodging of ereals. The experiments were to be organised as follows:

I. — EXPERIMENT IN THE USE OF ACIDIFIED HUMAN URINE, APPLIED AT HE RATE OF 220 GALLONS PER ACRE. — The urine will be prepared by collect- ıg it in carboys or vats tarred inside, in which concentrated sulphuric ıid is mixed with the urine in a quantity corresponding to 6 pints of acid er 100 pints of undiluted natural fresh urine. The mixture will occasion- ly be stirred up in order that the entire mass of the liquid may be acid- ed, and to prevent any fermentation. The spraying (which in small ex- eriments, may be made by brush application) will be carried out in the spots here the wheat is very high, particularly where weeding has not been suc- ssful in sufficiently preventing weed growth. In case of need, where heat suffers greatly from want of light, the treatment may be repeated second time of an interval of one week or more, but before the wheat emer- s from the glumes. For the second treatment, the acified urine might ı diluted with an equal volume of water.

II. — EXPERIMENTS IN TREATING WHEAT WITH FLOWERS OF SULPHUR. Flowers of sulphur (sublimated flowers of best quality) being more read- y oxidisable by the slow action of the air and light, should be preferred ı sulphur which has been first melted and then ground. Treatment with ılphur should be tried in those places where the wheat stalks are crowded, ı moist localities, particularly when the bases of the culms are seen to ex- ibit a tendency to blacken. The amount applied should be 178 lbs. per cre. This application must be repeated in case of lodging of the wheat, nd more especially if a progressive invasion of fungi is observed. As ı the case of the vine, the treatment must be carried out in hot and clear eather, with no wind. When the wheat is flowering treatment with sul- hur would be out of place, but it can be done before or after. The wheat rop having been got in and weighed, it should be ascertained whether the reatment has rendered the soil more fertile for the crop next in rotation.

79 · **Action of Ammoniacal Salts on the Growth of Barley.** — SODERBAUM H. G., in *Kungl Landtbruks-Akademiens Handlingar och Tidskrift*, LVth Year, Nos. 1-2, pp. 57-66. Stockholm, 1916.

Ammoniacal salts applied to soil under grass or grain crops, and manur- ıl with phosphates of low solubility (bone meal, tricalcic phosphate or hosphorites) give better results than sodium nitrate. Barley is an excep- ion to this rule as it seems to take more readily to nitrates. A special

series of investigations was undertaken by the writer with the specific object of studying and explaining this special behaviour of barley. The article sets out the results of these experiments. 84 glass vessels were used 50 cm. high and 25 cm. in diameter, each containing 28 kilograms of sandy soil plus 1.17 grms. of potassium chloride and 0.50 grms. of sodium chloride, which corresponds to 134 lbs. of K_2O per acre. They were divided into 3 groups of 27 vessels each, manured with 3 different kinds of phosphates: superphosphate, basic slag and bone meal, in the respective proportions of 3.65 grms. 7.27 grms. and 3.45 grms. per vessel, which corresponds to 134 lbs. of P_2O_5 per acre. To each phosphate there was afterwards added one of the nitrogenous manures: sodium nitrate, ammonium chloride and ammonium sulphate, in the proportions of 4.50 grms., 2.80 grms. and 3.48 grms. respectively, which corresponds to 134 lbs of nitrogen per acre.

Each group of 27 vessels was thus in turn subdivided into 3 groups of 9, differing in the nature of the nitrogenous manure; these 9 vessels were finally divided into 3 groups of 3, one of which received no further treatment, while the other 2 received an addition of magnesium sulphate and magnesium carbonate (magnesite) respectively, in the proportion of 1 grm. and 3.44 grms. Finally three pots were manured with nitrate of soda, without phosphates.

The barley was sown on the 4th May 1915 and the first seedlings appeared on the 11th. Towards the end of the same month, in the series: superphosphate, ammoniacal salts, sulphate of magnesia, it was observable that the leaves were yellowing and a stoppage of growth was taking place, followed in some instances by the death of the plant. These pathological symptoms developed with greater intensity in the case of the ammonium chloride, and less strongly in the presence of ammonium sulphate. When, however, the crisis had once been successfully passed, the plants started growing and developing again normally. In the series: superphosphate, ammoniacal salts, magnesium carbonate, no pathological effect was observed. The crop, collected on the 12th August, gave the results set out in the Table annexed.

The figures compiled in the Table confirm what was already perfectly obvious 3 weeks after sowing. Both in the superphosphate and in the bone meal series, the ammoniacal salts produced results inferior so those brought about by nitrate, and this difference is still more notable if the superphosphate alone is taken into account. Taking as equal to 100 the crop obtained by the use of nitrate, we have for the ammoniacal salts an average of 90 to 80, dropping even to 60 in unfavourable cases. It is interesting to note that with ammonium chloride better results are obtained on the whole than with sulphate, in spite of the serious symptoms of poisoning met with in the early phases of growth of the seedlings. In the series: bone meal ammoniacal salts, the magnesium carbonate raises the yield, while in the series: bone meal, nitrate of soda, it causes a marked diminution.

If we now examine the basic slag series, the picture presented is quite a different one. All the differences, more or less marked, between the

	Results of Experiments. Yield for each vessel in grams					Taking the yield obtained with phosphate and nitrate of soda as equal to 100, the result is:		
	Total	Grain	Straw	Weight of 1000 grains	Ratio Straw: grain	Total yield	Grains	Straw
	g	g	g	g				
Nitrate of soda	3.9	0.5	3.4	20.8	6.800	—	—	—
Superphosphate:								
Nitrate of soda	62.4	31.7	30.7	37.2	0.968	100.0	100.0	100.0
Nitrate of soda + sulphate of magnesia	68.9	34.0	34.9	36.7	1.026	111.1	107.3	115.3
" " + carbonate "	61.9	31.9	30.0	35.3	0.940	99.1	100.6	97.4
Ammonium chloride	13.4	7.2	6.2	25.4	0.861	16.0	21.4	10.2
Ammonium chloride + sulphate of magnesia	15.6	8.7	6.9	26.0	0.793	20.0	26.2	12.8
" " + carbonate "	53.1	29.8	23.3	31.9	0.781	84.1	93.9	72.8
Sulphate of ammonia	8.9	4.0	4.9	20.0	1.225	8.5	11.2	5.4
Sulphate of ammonia + sulphate of magn.	9.8	4.7	5,1	21.8	1.085	10.1	13.4	6.2
" " + carbonate "	59.2	33.6	25.6	33.0	0.761	94.5	106.1	81.3
Basic slag:								
Nitrate of soda	66.8	33.9	32.9	34.2	0.970	100.0	100.0	100.0
Nitrate of soda + sulphate of magnesia	66.4	33.9	32.5	35.7	0.958	99.3	100.0	98.6
" " + carbonate "	65.6	33.9	31.7	35.2	0.935	98.1	100.0	95.9
Ammonium chloride	65.3	35.0	30.3	32.5	0.865	97.6	103.2	91 1
Ammonium chloride + sulphate of magnesia	67.6	36.1	31.5	33.5	0.872	101.2	106.5	95.2
" " + carbonate "	67.8	36.8	31.0	34.5	0.842	101.5	108.6	93.5
Sulphate of ammonia	64.4	34.2	30.2	37.3	0.883	96.1	100.9	90.8
Sulphate of ammonia + sulphate of magn.	66.5	35.5	31.0	36.5	0.873	99.5	104.7	93.5
" " + carbonate "	63.4	33.3	30.1	39.0	0.904	94.5	98.2	90.5
Bone Meal:								
Nitrate of soda	53.6	25.2	28.4	27.9	1.126	100.0	100.0	100.0
Nitrate of soda + sulphate of magnesia	46.0	21.1	24.9	26.5	1 180	84.7	83.4	86.0
" " + carbonate "	28.7	11.3	17.4	21.6	1.539	49.9	43.7	59.0
Ammonium chloride	28.3	16.5	11.8	31.7	0.715	49.1	64.7	33.6
Ammonium chloride + sulphate of magnesia	21.5	12.3	9.2	29.1	0.748	35.4	47.7	23.2
" " + carbonate "	43.8	23.1	20.7	28.0	0.896	80.2	91.5	69.2
Sulphate of ammonia	18.1	10.5	7.6	22.4	0.723	28.5	40.4	19.8
Sulphate of ammonia + sulphate of magn.	18.1	10.3	7.8	22.9	0.757	28.5	39.6	17 6
" + carbonate "	47.4	24.7	22.7	27.3	0.919	87.5	97.9	77.2

ammoniacal salts and nitrate, between the sulphate and carbonate of magnesium, and between the different ammoniacal salts, tend to disappear.

In some cases the ammoniacal salts may produce a crop equal to th obtained with the nitrates, and if, under many other circumstances, the trate still retains an indisputable superiority, the fact is probably due a poisonous action of ammoniacal salts on the growing seedlings. An expl nation has been offered for the specifically favourable action of the am moniacal salts by connecting it with the acid physiological character the latter. Both in the chloride and the sulphate, the cation NH_4 alone absorbed and utilised by the plant, while the anions Cl or SO_4 are onl partly fixed, and hence there results a progressive increase of acidity i the plant substance, which is quite sufficient at this stage to produce a action injurious to growth. On these lines the favourable effects of magn sium carbonate in the series: phosphates, ammoniacal salts, might be ex plained, as likewise the superiority of the slag with large lime contents ov the other phosphate manures, etc. All that is here in operation would b merely the neutralising power of the two carbonates, that of magnesia an that of lime.

The following facts however conflict with this hypothesis:

1) The sick plants were young ones, and so small as yet that it cann be certain that they had absorbed nitrogen to an extent capable of notic ably influencing the composition of their substance.

2) If the weight of the dry substance of the 3 weeks old seedlin which grew in one vessel be taken as equal to 6 grms., there will be in all abo 24 grms. of green substance. Out of 24 grms. of fresh substance there 0.144 grm. of nitrogen, corresponding to 0.375 grm. of hydrochloric ac which would require 0.51 grm. of calcium carbonate for its neutralisatio Bone meal, however, contains calcium carbonate in the proportion of 1 grms, more than twice what is required, and in spite of this it does not s fice alone to counteract the injurious action of the ammoniacal salts.

3) Finally, it was observable that ammonium nitrate, though phys logically a perfectly neutral salt, produces the same effects as magnesi chloride and sulphate, though to a less extent.

Thus the hypothesis of a progressive acidification of the substa the plants must be dismissed, and it is more in keeping with the fac assume that what really takes place is a poisonous action of the ammo salts exerted direct on the plant.

Recent experiments appear to show that the carbonates of cal and magnesium promote the processes of nitrification by bringing abou transformation of the injurious ammoniacal salts into nitrates whic not injurious: hence their beneficial action.

971 - **Oat-growing in the State of Washington, United-States.** — SCHAFER E. G. an NES E. F., in *State College of Washington, Agricultural Experiment Station. Pul Washington, Bulletin* No. 129, 13 pp., 3 fig. Pullman, March 1916.

After wheat, oats are the most important grain crop cultivated in State of Washington. During the ten-year period which closed in 1914, average annual production was 11 629 253 bushels; the average area

cupied for the same ten-year period was 242 831 acres: the average yield 47.9 bushels per acre. Both the area under oats and the average unit production are in continual increase.

The major part of the oats produced by this State is grown in two widely separated districts: the county of Skagit in the western part, and the counties of Spokane and Whitman in the eastern part.

A study of the conditions peculiar to those sections where oats are grown in large quantities indicates that they thrive better in a rather moist climate. Trials for determining the quantity of moisture required by the different cultivations showed that oats in order to produce a unit of weight of dry substance, require more water than does barley or wheat. The maximum unit yields are obtained where the vegetative period is long and comparatively cool.

Table I sets out the characters of the most important varieties of oats in the State of Washington. They are determined from plants grown at Pullman. Table II indicates the unit productions obtained from the best varieties in open field experiments at Pullman.

TABLE I. — *Characteristics of the principal varieties of oats grown in the State of Washington.*

Variety	Height of plant	Rigidity of straw	Shape of panicle	Colour of grains	Number of grains per 5 g	Percent of hull	Weight per bushel	Date of ripening
Abundance	49.7 ins.	93.9 %	spreading	white	196	29.8 %	39.0 lbs.	9 August
Banner	48.7	89.9	»	»	198	28.4	39.7	8 »
Barrowhill	48.9	86.9	»	»	144	29.5	42.0	7 »
Bedfish Select	28.0	86.9	»	»	162	27.5	41.7	7 »
Big Day	41.4	87.2	»	light yellow	259	25.7	35.7	25 July
Danish	50.2	87.3	compact	white	190	27.4	39.0	13 August
Potato	46.7	95.2	spreading	»	228	27.0	37.7	11 »
Rye	52.2	86.4	side panicle	dark grey	162	29.9	40.7	4 »
Segenerated Swedish Select	49.9	92.2	spreading	white	180	26.3	42.3	6 »
Silver Mouse Wonder	50.9	89.4	»	»	171	24.9	41.7	7 »
Swan	49.4	81.3	»	»	186	24.3	41.0	9 »
Swedish	49.8	89.2	»	»	176	25.5	42.0	7 »
Swedish	49.6	91.9	»	»	183	29.1	45.3	1st »
Swedish	49.7	91.1	»	»	177	28.2	46.0	30 July
Welcome	48.4	92.0	»	»	166	27.9	41.3	7 August
White	42.6	86.9	»	»	387	—	52.0	13 »

TABLE II. — *Yield of some varieties of oats (averages of the 1914 and 1915 crops) and comparison between their Cropping Powers.*

Variety	Bushels per acre average	Comparative yield *
Abundance	81.7	111.9
Banner	78.3	107.3
Sparrowbill	76.5	104.8
Swedish Select	78.2	107.1
Sixty Day	77.2	105.8
Danish	65.4	89.6
Potato	65.9	90.3
Grey	64.0	87.7

* Taking as 100 the average of all varieties, which was 2 336 lbs. per acre.

972 - **Destruction of the Bean Germ.** — BUSSARD, in *Comptes Rendus de l'Academie d'Agriculture de France*, Vol. II, Year 1916, No. 19, pp. 550-551. Paris, 1916.

A method was required of destroying bean embryos without injury to the cooking value of the seed. The experiments covered three varieties: Algerian white, black and red beans. The experiments proved that when only a few seeds are concerned, immersion for one minute in boiling water is sufficient to deprive seeds which were previously capable of germinating in the proportion of 95 % of all germination capacity. When dealing with several pounds it will be prudent to prolong the immersion for 4 to 5 minutes. This time should not be exceeded, to prevent any cooking action being begun. The scalded beans, on drying in the open air, by spreading them in a thin layer on a flat surface, rapidly give up the water they have absorbed. Within 24 to 28 hours the bean appears to be perfectly dry, slightly wrinkled, and rather duller than the normal. It possesses very good keeping properties, and its cooking qualities are not impaired.

973 - **Some Factors affecting the Cooking of "Dholl" (*Cajanus indicus*).** — VISWANATH B., LAKSHMANA T. ROW and RAGHUNATHASWAMI AYYANGAR P. A., in *Memoirs of the Department of Agriculture of India, Chemical Series*, pp. 149-163, tables 6, diagrams 4, Calcutta, April 1916.

"Red gram" or "Pigeon pea" (*Cajanus indicus*) is grown in India as a food substance, which, in Southern India, is one of the products resorted to by vegetarians in order to increase the nitrogenous content of foods with a rice basis. While peas and other pulses are cooked fresh, the "red gram" is gathered when ripe, is dried in the sun and husked, the grains forming *dholl*, which is cooked and eaten. In the South, the grains after drying are mixed with red earth and water, they are left for one night in this mixture and are then dried in the sun before husking.

The writers have investigated the effect of the composition of the water on cooking. They made use of waters the content of solid matter in which ranged from 0 to 1 225 per 100 000. They observed that the presence of dissolved salts in the water largely affects the time required for cooking, which is longer in the case of salt-charged waters. Furthermore, the adding of bicarbonate of soda, which is commonly done in the South of India, reduces the time of cooking. The rapidity of cooking depends therefore on the one hand on the quantity of dissolved salts and on the other hand on the nature of those salts.

The method which consists in determining the time of cooking is a very primitive one however, which can only give approximate results. The writers adopted a different one based on a measurement of the quantity of starch substance dissolved during cooking. In addition to this weight of starch which passed into solution, they determined the weight of the dry substance of the *dholl* before and after boiling, as well as that of the nitrogenous substances in the *dholl* before and after boiling. The experiments showed that some salts, such as the salts of calcium and magnesium, sodium chloride and hydrochloric acid, sulphates and carbonates reduce the rapidity of cooking, the reduction being approximately proportional to the concentration of the salts. On the other hand, alkaline carbonates and alkalies produce an acceleration. The substances which accelerate cooking most are those which exert a greater solvent action on the albuminoid substances as compared with the starch, which points to the definitive conclusion that the rapidity of dissolution of the albuminoids forms the determining factor.

The writers also made it their work to ascertain whether the accelerating agents did not act by saponification of the fatty substances. They found that the fat content of the dholl exercises but very little influence, if any, on the rapidity of cooking. They furthermore observed that the practice of treating the gram with red earth and water entails quite a marked delay in the rapidity of cooking ; this treatment however is of advantage because it enables the gram to be more easily broken and husked. Finally, they studied the influence of different salts on the liquefaction of starch, utilising rice starch purchased as pure and passed through a 100 mesh sieve ; they found that, among the substances used, only caustic potash increases the quantity of liquefied starch, as compared with pure water ; this quantity is on the other hand reduced by the other products tried, hydrochloric acid, carbonates of sodium and calcium, sulphates of sodium and magnesium, chlorides of sodium, magnesium and calcium.

74 · **Comparative Experiments in the Growing of some Varieties of Potato at the Scientific Agricultural Station of Flahult, Sweden.** — VON FEILITZEN HJALMAR, in *Svenska-Mosskulturföreningen Tidskrift*, Year XXX, No. 2, pp. 110-123. Jönköping, 1916. STARCH CROP

Experiments in sandy and peaty soils with the following varieties of potatoes :

Early : Lucya, Midsommar, Harbinger, Juni, Makanta, Admiral, Nieuwe Muizen ; *Fairly early* : Mossros, Svalöfs 2171 and 3101, Geheimrat Haas, Enorm, Svalöfs 2031 ; *Rather late* : Gertrud, Non plus ultra, The Faktor, Makalös, Up to date, Högantis, Freiherr von Wangenheim,

Svalöfs 3 (d'Eldorado), Jubel, Union, Danuska, Svensk Gamla röda, General Cronje, Svalöfs 72 (de Magnum bonum), Holt Jämtlandspotatis, Eldorado, New Guardian, Hassia, Roode Star; *Late*: Juvel and Böhms Erfolg; *Very late*: Switez and Svalöfs 1189.

The yield of potatoes was on the average very high: 11.94 tons per acre. Gertrud leads with 18.1 tons, after come Lycya, Mossros and Juvel, with 17; 16.4 and 16.2 tons respectively.

In the different groups, the best results were obtained with the following varieties:

Lucya 17; Midsommar 13.9; Harbinger, 11.9.
Mossros 16.3 and Svalöfs 2171, with 14.9.
Gertrud 18; Non plus Ultra 15.84; The Faktor 15.76; Makalös 14.85 and Up to date 14.85.
Juvel 16.25.
Switez 11.2.

The proportion of small tubers averages 9.1% with a maximum of 20.9% for Gamba Svenska roda, and after this New Guardian, 19.6; Nieuwe Muizen, 17.9 and Boode Star, 17.2%. The average starch content for the different varieties is shown by the following table:

Varieties	Maximum	Minimum	Average
Early	15.55 %	12.93 %	13.57 %
Fairly early	16.93	13.00	14.93
Rather late	17.85	13.13	15.23
Late	17.65	16.73	17.19
Very late	18.55	17.45	18.00

The leading position is taken by Switez, with 18.55 %; next come Roode Star (17.85), Erfold (17.65), Cronje (17.60), Svalofs 1189 (17.45). Non plus Ultra (17.35), Gertrud (17.28) and Makalos (17.03 %).

The following figures in respect to the connection between the nature of the soil and the starch content are of some interest:

Varieties	Peaty soil	Sandy soil	Sand with little humus	Pure sand
Early	12.96	14.02	13.65	13.66
Fairly early	13.77	15.95	15.37	15.45
Rather late	14.32	14.97	15.70	15.95
Late	15.55	17.60	17.45	18.15
Very late	15.85	18.70	18.65	18.80

The percentage of starch therefore increases when the humic substance is reduced. The maximum yield of starch per acre was obtained with Gertrud (7000 lbs); after which come Non plus Ultra (6166), Juvel (6080), Makalös (5671) and Wangenheim (5371 lbs per acre).

It is proposed to continue these comparative experiments for 4 years longer.

Economic Desirability of Tree Planting in Grasslands. — SPIRIDONOV N., in *Selskokhozyaistvennaya Gazeta* (*Agricultural Gazette*), No. 12 (128), pp. 310-311. Petrograd, March 1916.

Observations effected during a period of 25 years on more than 44 hec- of the zone of "grey earths" in Russian Europe, highly suitable for iculture (1). The above area was divided into 18 meadows, part of ch was already free from trees when purchased; the remainder being n, the trees being retained as far as possible. The soil is peaty, sandy 'podzol".

During two or three periods of great drought, the value of the treeless slands fell off 12 to 50 %, while that of the grasslands planted with s increased 16 %. In rainy years, the latter exhibit much better vegeta- than that of grasslands without trees.

At the beginning of the period of utilisation the treeless grasslands were best as regards vegetation; about 12 years afterwards however the com- tion and appearance of the vegetation suddenly grew worse, and at the ent time (25 to 30 years after) these grasslands have the aspect of moor- l covered with *Nardus stricta* L. Tillage, manuring and sowing with l forage crops were not effective in producing a permanent improve- t of these grasslands.

The turf layer was broken up at a suitable moment, and the grass- ls were ploughed, after which various crops were sown but the result ined was always the same. In the first year the grassland produced cwt of hay per acre containing 80 % of leguminous plants; in the 2nd it produced about 17.9 cwt. of hay in which Gramineae predominated; ie 3rd and 4th year the crop became poor; it afterwards fell off rapidly nch an extent as to be below that of the uncultivated grasslands.

In the grasslands planted with leafy trees (in this case birches) the ve- tion begins to improve towards the 12th year after they have begun e utilised, and attains its maximum development between the 16th the 20th year. Then, when the tops of the trees are in contact as well heir roots, there is a rapid retrogression: vegetation becomes sparser, leguminous plants disappear and the crop suddenly declines. If howe- during this period the trees are felled, there is for 3 or 4 years a fine hay , rich in *Lathyrus pratensis, Trifolium montanum*, and, it appears, *incarnatum*. This operation however is not desirable. It is better to content with poor crops for 6 to 8 years (which crops, however, never below the level of those yielded by *Nardus stricta* in the treeless grass- ds), after which the trees are felled. After 28 years, each birch tree, ac- ding to the writer's investigations, yields 2.8 cubic metres of wood apart m branches. In short, these observations hold out the prospect of ob- ning at the same time a wood which, at the rate of 144 trees per acre, l yield in about 28 years 400 cubic metres of wood and also good hay crops.

(1) The "grey earths" of the wooded and steppe zone form the transition from the "pod- " zone to that of "tchernoziom". They precede the steppes. In European Russia their lth ranges from 62 to 124 miles. (*Ed.*)

The above observations relate to grasslands very irregularly planted with birch trees, the roots of which spread out near the surface of the soil and deprive it of moisture. When the roots of neighbouring trees interlace in the 20th year, the falling off in the hay crop is probably due to shortage of water. If, however, instead of birches the grassland is planted with deep-rooted alders, this phenomenon does not take place. Round about the alders the vegetation is of better appearance than round the birches, and is higher ; it extends right up to the tree trunks without any reduction in height or change in colour, while around the birches circles of weaker and discoloured vegetation form which extend in the course of time. With regard to the greater care required by the upkeep of high forest alders as compared with that demanded by birch trees, the desirability from the economic point of view of planting grasslands with alder is brought out clearly with 220 alders per acre a good high crop may be maintained without manuring and without any hindrance to the growth of the grass and the use of the reaper. The trees may be replaced every 14 or 15 years without injuring the grassland, by planting young trees 5 or 6 years old in the clear spaces 7 years before felling the old ones.

Anticipating the objection of insufficiency of sunlight on a piece of grass land planted with trees, it is stated that though this objection may be true for a wet climate it is not true for a dry climate, where excessive sunshine results rather in burning the grass than promoting the formation of chlorophyll.

Finally, stress is laid on the importance of the potassic and phosphatic manure formed by the large quantities of dead leaves which a forest 17 to 22 years old is capable of yielding the elements of which are taken from the subsoil.

Although these observations do not constitute really strict scientific experiments, they nevertheless enabled the writer to conclude with certainty that grasslands planted with trees or wooded meadows will on the average yield more hay than grassland without trees ; furthermore it supplies timber. It is, however, necessary, to repeat the experiments with cultivation of the alder tree in regular lines to the number of 184 to 216 trees per acre of grassland, doing the same with the birch and the oak, in order to ascertain definitively whether the combination is desirable.

976 – **Moisture Content and Shrinkage of Forage and the Relation of these Factors to the Accuracy of Experimental Data.** – O'NEAL H. N. and MCKEE ROLAND. in *United States Department of Agriculture*, Bulletin No. 353, 37 pp. Washington, D.C., March 4, 1916.

The variation in moisture content in field-cured forage often gives rise to errors greater in amount than the differences in yield between improved varieties or different methods of culture. A study of the use of samples in correcting forage yields indicates the following results :

1) Air-dried samples are a little less accurate than oven-dried samples, but the difference is so small that the air drying of samples can be relied upon for all practical purposes on correcting forage yields.

2) Much greater extremes are found in the samples of field-cured

terial than in the samples of green material, indicating that duplication samples is more important in the former than in the latter.

3) Corrections by means of samples can be accurately made from her green or field-cured material, provided care is used in sampling.

4) Considering accuracy of results, facility of handling, and ease figuring percentages, 5-pound samples of field-cured material and 10-und samples of green material are recommended as the most desirable es for practical use

5) Samples need not be duplicated more than three times.

6) The percentage of moisture in the different crops at that period of owth when they are ordinarily harvested for forage was as follows: Al-fa at Chico, Cal., 75 to 78 per cent., average 76.9 per cent; Alfalfa at Arling-n Farm, Va., 74 to 76.5 per cent., average, 75.2 per cent.; Tall oat-grass and hard-grass mixture at Arlington Farm, Va., 71 to 73 per cent., average, per cent.; Timothy at New London, Ohio, when in full bloom, average, .2 per cent. Sorghum at Amarillo, Tex., 70 to 63 per cent., average, 71.2 r cent. These percentages are probably near the average for each crop, t the fact that McKEE found 75.8 per cent. and FARREL an estimated 79.5 r cent of moisture in alfalfa indicates that it will be impossible to establish y arbitrary percentage of moisture in the green plant as a basis for cor-ting forage yields.

7) The average amount of moisture in field-cured material was as lows: Alfalfa 2.3 per cent.; timothy, 20.3 per cent.; tall oat-grass and hard-grass mixture, 29 per cent.; sorghum, 43.2 per cent. The moisture ntent of field-cured material varies so widely that it cannot be foretold h accuracy.

The use of the sample method in correcting forage yields would atly assist in standardizing agronomic data and do much to promote ater accuracy in field tests.

The system of correcting yield data by the use of air-dried samples is most value in succulent crops like sorghum and Sudan-grass and is of st value in fine-stemmed plants like millet, which cure quickly and rather npletely.

The relation of the moisture content to the stage of development in plants was studied in alfalfa, timothy, and sorghum. The results were follows:

1) Alfalfa at Chico, Cal.: Very young (12 inches high), 78.9 per cent.; tenth in bloom, 77.1 per cent.; full bloom, 74.6 per cent.; past full om, 73.4 per cent.

2) Sorghum at Amarillo, Tex.; Very young, 90.6 per cent.; shooting heads 87.1 per cent.; beginning to head, 84.8 per cent.; full bloom, 4 per cent.; seed ripe, 75.3 per cent.

3) Sorghum at Hays, Kans., varied from 89.2 per cent. when very ung to 73.2 per cent when seed was ripe, showing practically the same adations as at Amarillo, Tex.

4) Timothy at New London, Ohio: Very young (10 to 12 inches high) 5 per cent.; just heading, 76.6 per cent.; early bloom, 71.4 per cent.;

full bloom, 67.2 per cent.; leaves fading, 58.6 per cent.; seed mature, 51.2 per cent.

5) The excessive percentage of moisture in young sorghum explains the very chaffy character of sorghum hay when the crop is cut too soon, and the 90 per cent loss in weight is an additional reason why sorghum should be fairly mature before it is harvested.

6) The moisture content of any crop at a given stage of maturity is not constant, but may vary with the conditions under which the crop is grown.

A study of the rate of loss of moisture in forage during the early stages of curing shows the following results:

Crop and location	Moisture after:				
	½ hour	1 hour	2 hours	3 hours	4 hours
	per cent.	per cent.	per cent.	per cent.	per cent.
Alfalfa at Chico	—	17	35	—	69
Alfalfa at Arlington Farm	6	14	23	28	32
Tall Oat grass and orchard grass at Arlington Farm	5	12	24	30	34
Timothy at New London	6	10	18	25	30
Sorghum at Hays	2	5	9	12	13

The approximate losses in the different crops were.

1) The rate of loss of moisture after cutting differs in different va eties of the same crop, as well as in different crops.

2) Although the Arabian alfalfa loses moisture faster than the Pe vian or ordinary alfalfa in the first one or two hours after cutting, s the total percentage of moisture is about the same for the three varieti

3) A high percentage of leaf surface in alfalfa varieties is correlat with a rapid loss of moisture immediately after cutting, but it does not dicate a high moisture content.

Studies of the variation in the moisture content of growing alfal during a single day at Chico, Cal., show an average of 1 per cent. mo moisture in the alfalfa at 8 o'clock a. m. than at 3 o'clock p. m.

Studies of the shrinkage in hay after storing and variation in moistu content due to changes in atmospheric humidity made with baled oat hay Chico, Cal., and loose timothy hay at New London, Ohio, indicate results follows:

1) At Chico, Cal., where the atmospheric humidity changes radica from the dry summers to the wet winters, baled oat hay showed a shrir age in 1914 of 9.1 per cent. between June 1 and August 31, and a g in weight from August 31, 1914, to February 25, 1915, of 5.9 per cent. of t original weight.

2) The results at Chico, Cal., indicate that even baled hay responds ticeably to changes in atmospheric humidity, and that hay dealers are stified in taking into account the shrinkage of their hay when fixing ices.

3) The results secured at New London, Ohio, with loose timothy indite a shrinkage of 8.6 per cent. in one lot and 15.6 per cent in another lot, ien the hay was stored in a barn for about three months. The effect a week of rainy weather was indicated by an increase of weight in the se hay.

77 - **Investigations into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibility.** — PERKINS ARTHUR I., PHILLIPS J. H., SPAFFORD W. I. and MAY W. S., in *Department of Agriculture of South Australia, Bulletin* N° 82, pp. 1-38, 33 tables + 3 fig. Adelaide, 1914.

From the investigations, which were conducted during the years 1911-13, the writers have drawn the following general conclusions:

The yield of a crop of wheat cut down for hay will vary considerably cording to the stage of development to which the crop has attained. he combined results of the two seasons' experiments show that the avege increase in yield above that of a crop cut in the full bloom stage to be.

20.31	per cent.	in the case of hay cut	6	days	after	full bloom
24.02	»	»	13	»		»
36.04	»	»	21	»		»
32.62	»	»	28	»		»
21.90	»	»	35	»		»
14.34	»	»	42*	»		»

It follows, therefore, that maximum yields will be secured from cuts ken about three weeks after full bloom, at a time when the grain is just out to leave the milky stage. In this connection it should be recollect- that these three weeks have reference to an early wheat grown under conions of climate such that there elapses a period of six weeks between full oom and the ripeness of the grain. In a general way it is perhaps better state that maximum hay yields may be expected from cuts taken when e grain is about to leave the milky stage and enter upon the dough ge. In the three weeks that follow full bloom time, total increase in hay ld is distributed between ears on the one hand, and culms, and flag on e other, but in uneven proportion, the ears increasing in weight at a more accelerated ratio than the culms and flag. The following figures ll serve to indicate the nature of the increases gained respectively by s on the one hand, and by culms and flag on the other, over and above ir original weight at full bloom.

	Ears.	Culms & Flag.
At full bloom time	100.00	100.00
Six days after	137.77	118.28
Thirteen days after	153.10	119.08
Twenty-one days after,	246.75	130.48
Twenty-eight days after	321.05	106.70
Thirty-five days after	337.00	92.54
Forty-two days after (grain ripe).	540.40	83.33

Grain ripe.

Therefore, when the grain begins to leave the milky stage there is no only a great disproportion between the relative weights of ears on the or hand, and culms and flag on the other, but relatively to the period of fu bloom, a loss of weight in the latter, which although at first compensated fo by a corresponding increase in the weight of the ears, becomes in th end an actual loss of what might have been good feeding material ha the crop been cut earlier. In other words, hay cut after the milky stage, the grain tends more and more to become ill balanced hay, in which th culms and flag rapidly lose their feeding value; whilst if the hay is not c at least a fortnight earlier than the ripening of the grain there arises to t grower an actual loss of hay.

In the matter of chemical composition the chief differences betwe hay cut at full bloom, and later cuts are as follows: — 1) Progressi decrease in the percentage of mineral matter and corresponding increa in that of organic matter characterises the gradual ripening off of the cr 2) The percentage of proteins shows a tendency to rise during the fi three weeks; thereafter it steadily declines to the ripeness of the gra 3) The percentage of fat appears to remain more or less stationary throug out the whole period. 4) The percentage of carbohydrates rises regular and steadily in the ears thoughout the six weeks. It is balanced by a co responding regular decrease in culms and flag. 5) Conversely, whilst t percentage of fibre steadily rises in culms and flag, it equally steadily d clines in the ears.

A heavy loss of dry matter was noted in the last two or three weeks the development of the wheat crop, a loss which attained to 22.9 per ce of the maximum cut in 1911, and 6.41 per cent, of the maximum cut 1912. This loss, no doubt, must be attributed chiefly to the fall of t exhausted flag, and to a less degree to occasional shaking out of grain a other accidental causes; to the weakening or suspension of the assimilati function; and to the occasional leaching action of rain on a dry, porc tissue. In each year, however, we found that the proportional loss mineral matter was considerably greater than that of organic matter, a we infer therefrom that as maturity advances there must be some sort migration of the mineral matter towards the root system.

The loss of weight on drying of a wheat hay crop becomes gradua less and less as the ripening of the grain is approached. It is represent by close on three-quarters of the green weight of the crop in the full blo stage, and by less than one-quarter of the green weight when the grain ripe.

The percentage of moisture retained by wheat hay varies sligh with the conditions under which the hay was dried. Generally speaki however, early-cut hay retains slightly more moisture than late-cut h In round figures, 10 per cent. represents the average moisture content South Australian wheaten hay.

When a crop of hay is left to dry in a field, the loss of weight obser is not exclusively the result of the evaporation of water. Intimate chemi

tions set up in the drying cells of the plants, the ultimate result of which ie destruction of more or less organic matter.

For wheaten hay, losses in this direction may attain to slightly r 1½ per cent. of the original green weight, and they are connected dly with the breaking down of carbohydrates.

Direct digestion experiments show that hay cut at full bloom is more ily digestible than any hay cut at later periods, and that in general the estibility of wheaten hay decreases by regular steps as the period of com- e ripeness is approached. In this connection there is a difference of r 12 per cent. between the digestibility of hay cut at full bloom and that ay cut a week before the ripening of the grain. This superior digesti- ty of wheaten hay cut at full bloom holds good all long the line, with exception, perhaps, of the doubtful case of the mineral matter. The ular decline in the digestibility of hays cut at later periods is most marked he case of proteins and fibre. Carbohydrates are, on the whole, rather atic in their behaviour, and perhaps on the whole they may be considered re or less stationary in their direct digestibility. The albumenoid ratio atio found to exist in any foodstuff between the digestible proteins on the hand, and the balance of the digestible non-nitrogenous organic matter the other) is narrower and more favourable in character in the earlier hays than in those in more advanced stages of development. This arises m the more highly digestible condition of the proteins in the less ma- re cuts of hay, and the overwhelming preponderance of carbohydrates the later cuts.

It appears that there is nothing to be gained and much to be lost, deferring the cutting of wheaten hay until the grain begins to enter upon e dough stage. It involves, as a rule, both a reduction in total yields hay and a reduction in quality represented by a reduced digestibility and wider albumenoid ratio. Assuming that hay-cutting operations can be mpleted within a week to 10 days, these operations should be put in hand t later than a fortnight after full bloom.

These experiments amply confirm the value of the usual commercial andard by which hay is judged, viz. colour. It may be taken for granted at any hay that is not of good bright green colour is of inferior quality feeding purposes, although it might make excellent litter.

- ***Paspalum* spp., Forage Plant in Argentina.** — *Gaceta Rural*, IXth Year, o. 107, pp. 685-689. Buenos Aires, June 1916.

The genus *Paspalum* of the family of Gramineae comprises more than species scattered throughout the temperate, sub-tropical and tropical ons of the entire world, one half being in America (100 in Brazil and ut 40 common to Brazil, Argentina and Uruguay). In Argentina, from province of Jujny to that of Buenos-Aires, several of the principal spe- of *Paspalum* occur fairly widely, comprising those regarded as the sof- and best forage plants, for instance: *P. dilatatum* Poir., *P. notatum* gge, *P. plicatulum* Kuth (Mich.), *P. uruguavense* Arech., *P. pumilum* s. All these species form excellent pasturage, particularly *P. dila- um saccharíferum* ("granilla melosa" or "pasto miel"), *P. notatum* and

P. plicatulum, which is peculiar to sandy soils. There are also the following marsh species: *P. Larrañagai* Arech., *P. multiflorum* Doell., *P. fasciculatum* Willd., *P. ferrugineum* Trin., which may serve for pasturage during times of drought; finally, *P. scoparium* Flügge and *P. barbatum* Nees, thrive on the patches of moist soil which occur on stony surfaces.

Paspalum grasses are generally sown in autumn or spring with other forage plants, preferably with clover or lucerne in the proportion of 5 to 7 lbs per acre, after giving a good dressing to the soil. It is best to feed them green to the livestock before complete flowering. For this purpose they are cut at that time, or fed to cattle off the land at an early moment, after which a second crop is obtained. *Paspalum* may be sown alone, in order to improve existing grasslands, or for seed production. In the latter case sowing is at the rate of 26 $^3/_4$ to 35 $^3/_4$ lbs per acre, which yields a crop of 357 to 535 lbs of seed. The seeds are also cropped from plants growing wild on stubble.

The analytic data contained in the appended Table are interesting as they indicate the nutritive value of some of the principal species of *Paspalum*.

Chemical Composition of some species of Paspalum and other Forage Plants.

Species	Origin	Ash	Total nitrogen	Crude protein	Albuminoids	Fat	Crude fibre	Carbohydrates
Paspalum dilatatum.	Lomas de Zamora . .	12.45 %	1.83 %	11.17 %	—	3.20 %	31.21 %	41.97
» »	Jujuy	11.91	1.47	9.23	6.88 %	1.16	27.39	50.31
P. notatum	Lincoln (Buenos-Air.)	12.45	2.09	13.06	9.32	2.47	24.15	47.87
» »	Santa Fé	9.29	2.09	13.06	9.32	2.58	31.35	43.72
» »	Entre Rios	10.58	1.10	6.87	5.98	0.96	37.10	44.46
P. Larrañagai	San Luis	12.40	1.52	9.16	6.84	0.94	37.43	39.27
P. pumilum.	Entre Rios	9.06	1.22	7.65	6.79	1.30	27.12	54.87
Lolium perenne L. .	Buenos-Aires	10.18	1.85	11.56	6.56	2.27	33.18	42.81
» »	Santa Fé	11.50	2.10	13.12	7.93	2.10	31.57	41.71
Lolium brasilianum Nees	6 specimens.	11.69	2.11	13.18	8.53 *	2.83	23.44	48.86
Bromus unioloides H. Bet K.	16 specimens	11.76	2.57	15.96	10.26 **	2.83	20.50	48.95

* Average of 3 analyses. — ** Average of 6 analyses.

Calculating the nutritive ratios for 3 typical specimens, we have:

Paspalum dilatatum	(Lomas Zamora)	1 : 9.1
Lolium perenne	(Buenos-Aires)	1 : 7.3
Lolium perenne	(Santa Fé)	1 : 9.1

at is to say, on comparing with Perennial rye grass (*Lolium perenne*) which ows in the same parts, *Paspalum dilatatum* is not inferior in value from e point of view of richness in useful elements and mutual proportions of e latter. If this fact is taken into account, and also the abundance and od quality of the forage supplied during the entire year and the prefer- ce cattle show for it, one is forced to the conclusion that it is at least equal English rye grass which has been imported into the country.

The same may be said of other wild forage plants occurring widely in rgentina, which might very well and at very small cost take the place of e numerous exotic species which Argentine breeders are endeavouring introduce into the country at heavy expense.

9 - **Natal Grass (*Tricholaena rosea*), a Forage Plant for Hot Countries.** — TRACY D. C., in *U. S. Department of Agriculture, Farmer's Bulletin* 726, 16 pp., 4 fig., Washington, M. S. June 8, 1916.

Tricholaena rosea, called "Natal Grass" in the United States, is a ative plant of South Africa, but long acclimatised in Florida. For some ars past its cultivation in the sandy soils of that State has increased, and s also spread along the coast of the Gulf of Mexico as far as South Texas. the United States this forage plant can only be cultivated right in the uth. It is the most valuable forage plant hitherto found for the sandy ils of Florida, and will no doubt prove equally valuable in Southern Texas d further west in Arizona, as also in California.

Tricholaena rosea is a perennial, but does not survive the winter every- here when the temperature falls much below 0° C. Heavy frosts destroy e fallen seeds, rendering natural propagation of the plant impossible. Florida it is usually grown as an annual. The soils most suited to it e well-drained sandy soils. In compact soils it does not appear to spread self well. It is suitable as a summer crop following on winter crops such oats or kitchen garden plants. When a sandy soil has been sown with *richolaena rosea* it is not necessary to re-sow if the land cultivated in autumn as produced a winter crop and has been cultivated or harrowed again in e spring. If the soil on which this forage plant is grown is not used to oduce a winter crop and is not cultivated, it will furnish an early spring op and a large number of cuts in the course of the year. The total hay op, however, will be about equal to that obtainable by growing a winter op. The average unit production is 40 to 50 cwt. of hay per acre or about 5 cwt of hay per acre per crop. In good years, crops twice as great as ese are obtained.

Tricholaena rosea is not adapted for forming a pasture, and ranks poorly s a grazing grass. Its hay is excellent; it dries easily, is highly nutritive, oks good and is much liked by the animals. Its composition is as indi- ated in the appended Table, as compared with the average composition f Timothy (*Phleum*) resulting from analyses of 272 samples.

Chemical composition (relatively to dry matter) of the hay of Tricholaena rosea and Phleum pratense.

	T. rosea.	*P. pratense*
Cellulose	40.72 %	32.86 %
Ash	5.56	5.82
Protein	8.25	7.87
Nitrogenous extract	43.47	50.40
Fats (ether extract)	1.99	3.05

When the seeds crop is looked after and carefully handled, its quality is excellent in Florida. For proper keeping of the seed it is essential to dry it rapidly and completely.

T. rosea exhibits numerous and very divergent varieties: the United States Department of Agriculture is at present carrying out a field trial with a view to producing standard improved types. Some varieties were also recently introduced into Brazil.

980 - **Experimental Studies in Italy, for determining the Cultivation Value of Two Wild Lucernes.** — Josa G., in *L'Italia agricola*, 53rd Year, No. 6, pp. 250-253, 5 fig. Piacenza, June 15, 1916.

Scythe lucerne (*Medicago sativa* var. *falcata*) and variable lucerne (*M. sativa* var. *varia*) have repeatedly been pointed out by ancient and modern Italian agriculturists as being likely plants for forming artificial grasslands on poor, dry, barren soils, especially in the Southern provinces. Up to the present, however, no cultivation trials had been carried out. The latter have now been undertaken by the Office of Travelling Agricultural Lecturers at Campobasso with seeds originating partly from the Abruzzi and partly from the province of Campobasso.

In the first year of cultivation (1911), there were no noteworthy weather events; 1912 and 1913 were exceptionally dry years; the two following years were very rainy. Growth was from the outset poor and tardy in the case of *Medicago sativa* var. *falcata*, mediocre for variable lucerne and luxuriant for the *M. sativa* cultivated as a standard of comparison. These differences were maintained during the entire period of the experiment and were confirmed by the crop. The following are the conclusions:

1) Scythe lucerne possesses very little cultivation value and both for this reason and from other considerations, such as the difficulty of getting in the crop and the coarse quality of the forage, it can only be used in mixtures intended for the formations of permanent grasslands;

2) Variable lucerne is more promising, and if it were selected and improved by cultivation it might perhaps replace *M. sativa* in all those cases though they are few, for which the latter is unsuited;

3) Wherever it is possible to cultivate *M. sativa* even with mediocre results, the latter always exceeds what may be anticipated from the wild lucernes.

981 - ***Medicago orbicularis*: Attempts at Introduction into the United States.** — McKee Roland, in *U. S. Department of Agriculture, Farmer's Bulletin*, 730, 9 pp., 3 fig. Washington, D. C., June 2, 1916.

Medicago orbicularis, indigenous to the Mediterranean region, was introduced into the United States in 1899 by the Foreign Seed and Plant Introduction Office of the Department of Agriculture. In the following years, several other small lots of seeds of this species were introduced from the same region, but practically all the experimental work carried out was done with seeds from a sample which arrived from Algeria in 1902.

Medicago orbicularis has been tested on a larger scale in California, where it proved to be peculiarly well adapted. In the Southern States of the Union it was not sufficiently dried to allow of determining its value definitely. The work accomplished, however, already indicates that it is perhaps possible to use it with success in all those parts which enjoy a very mild climate, and where *Medicago arabica* is at present grown.

In order to thrive, *Medicago orbicularis* requires a temperate climate, the winter temperature of which does not go below — 10° C. It is not exacting as regards soil and humidity, and thrives under very diverse conditions. As a pasture plant it is especially valuable in the most temperate districts of the south-west of the United States, where it is preferable to *M. hispida denticulata* and *M. arabica*. It is easy to lay down land to pasture with *M. orbicularis* as it requires nothing beyond sowing. If, however, the soil does not already contain the bacteria giving rise to the formation of leguminous nodules, they must be inoculated into it. This inoculation is not necessary in those soils where *Medicago arabica* or *M. sativa* have already been grown. *M. orbicularis* gives good hay, but it is difficult to mow owing to its drooping habit. Usually it gives good seed crops, but the drying and threshing of the hay are rendered difficult owing to the fact that the seeds fall readily. In trials carried out at Chico, California, from 1908 to 1911, *M. orbicularis* gave as the average of this four-year period 8.4 cwt. per acre of husked seeds. *M. arabica* grown as a standard of comparison, gave during the three-year period 1908-1910 an average of 3.1 cwt. per acre.

The Author demonstrated by experiment that husked seed kept in ordinary stores had their germination capacity reduced by about one half after 3 or 4 years; after 7 years it was reduced to $\frac{1}{3}$ of its value. On the other hand the one year old seeds possess a good germination capacity (in 1911 it was 91 % with 4 % of hard seeds).

As a green manure, *M. orbicularis* possesses practically the same value as *M. arabica* and *M. hispida denticulata*.

982 - **The Green Pea as a Forage Plant in North America.** — Vinall H. N., in *United States Department of Agriculture, Farmer's Bulletin*, No. 690, 24 pp., 10 fig. Washington, D. C., October 8, 1915.

The green pea (*Pisum sativum*) is cultivated widely in North America as a forage plant and is then called "field pea" or "Canada field pea". The cultivation of the green pea is of very ancient date, but up till latterly was intended exclusively for human food. It is now widely cultivated in Canada as a forage plant, as well as in the States of the North American

Union, and, further south, in the high regions of the Rocky Mountains. It deserves to be more extensively grown in the Southern States of the Union.

To enable the forage green pea to thrive, there must be a temperate season coinciding with its period of growth. Great heat is much more injurious than frost, which is only disastrous if the plant has begun to form its pods. The best crops are obtained on clayey-sandy soils. The best varieties are: among the early ones, "French June"; among the mid-season ones, "Golden Vine"; and among the late varieties, "Canadian Beauty" and "Blue Prussian". Among new varieties, "Carleton" and "Bangalia" are preferred in the North-West States of the Union. In the Northern States, sowing must be carried out in spring as early as possible, that is as soon as the soil can be worked. In the Southern States, sowing must take place in the autumn or at the end of winter. In wet parts, from 89 to 210 lb of seed per acre is required, and in dry regions 60 to 180 lb per acre suffice. Sowing in rows is preferable. For hay production, it is desirable not to mow until the pod is well formed. For seed production, cropping must be delayed until the latest pods have begun to turn yellow. Mowing and hay making may be carried out by ordinary machines with special devices fitted on them (described and explained by the writer) to prevent the teeth of the mower getting choked up, to lift the stalks and enable the cutting bar to pass beneath, for binding, etc. Threshing may be carried out by means of an ordinary grain separator from which the majority of the concave teeth have been removed. The speed of the drum is thus reduced.

In San Luis Valley (Colorado) it has been found that the green pea forms good pasture for pigs and sheep. This forage plant deserves to be tried in other districts where grown, particularly those lying near mountain ranges.

When the green pea is grown for forage it is best mixed with oats or rye.

The green pea seed has been successfully used as a concentrate in rations for the production of meat or milk in cattle, sheep, pigs and dairy cows. The waste from green pea canning factories is sometimes put into silos and good results obtained, particularly with dairy cows.

In the citrus plantations of Southern California, the green pea has furnished a good green manure.

983 - **Cytisus as Forage** (1). — PEREZ GEORGES V., in *Bulletin de la Société Nationale d'Acclimatation de France*, 63rd Year, No. 6, pp. 217-220. Paris, June 1916.

The farmers of the island of Palma in the Canaries, use certain species of *Cytisus* as forage, namely "Tagasaste" (*Cytisus proliferus*, var. *palmensis* Christ), "Gacia" (*Cytisus maderensis* Masf. = *Teline stenopetala* W. and Berthelot) and also "Herdanera" or "Gacia blanca" (*Cytisus pallidus* Sprague = *Genista splendens* W. and B.).

The writer protests against those prejudices which maintain that neither horses nor cattle will touch these plants, that the seeds of the latter will not grow, and that all forms of *Cytisus* are poisonous like laburnum

(1) See *B.* June 1916, No. 640. (H.)

Instead of allowing the Tagasaste to grow into a tree, it must be cut two or three times per year to a height not exceeding a yard from the ground, in order that its tender branches may be more abundant. As with many other forages, animals must become accustomed to it, but once the taste has been acquired they continue very fond of it. Chopped and mixed with dried straw it is a perfect food comparable with lucerne. Tagasaste grows in mountainous and stony soils from which the plough is precluded, and resists drought admirably, enriching the soil by its roots which fix atmospheric nitrogen.

In the opinion of the writer it is highly desirable that these plants should be more extensively grown as forage in the Mediterranean basin, particularly in regions where the rainfall is scattered over wide intervals or where the summer is very dry, and consequently livestock breeding is very difficult.

684 - **Comparative Experiments on the Growth of some Varieties of Carrot at the Scientific Agricultural Station of Flahult, Sweden.** — VON FEILITZEN HJALMAR, in *Svenska Mosskulturföreningen Tidskrift*, Year XXX, No. 3, pp. 128-129. Jönköping, 1916.

Experiments in sandy soils with the following varieties, which were lifted from the 10th to the 13th October.

Varieties	lbs per acre of roots	Weight per imperial bushel in lbs.	Average weight of one root in lbs	Tops in tons	Dry matter %	Dry matter lbs per acre	Relative yield: Roots 1914	1913	1912	1911	1910	Dry matter per acre 1914	1913	1912	1911	1910
Jätte (Champion)	35 060	44.8	.6094	87.6	11.75	4 124	100	100	100	100	100	100	100	100	100	100
» (Welbuff)	33 901	44.8	.6864	93.9	12.18	4 124	96	98	102	90	82	100	102	107	88	96
Hvit jätte »	32 920	43.2	.7106	121.9	11.25	3 704	94	104	99	—	92	90	116	96	—	96
Gul jätte »	32 385	43.2	.6666	123.5	11.68	3 778	92	100	77	77	96	92	101	85	87	107
Rödmellanmorot	26 765	44.8	.4818	77.7	13.05	3 484	76	94	80	79	—	85	101	91	62	—

Gul jätte (yellow giant) in 1914 yielded the best results, both as regards the total weight and the quantity of dry matter; good results were likewise obtained with the two varieties of hvit jätte (white giant).

All the varieties kept very well under storage. The loss of dry matter from the autumn to the middle of March ranges from $^1/_8$ to $^1/_5$, and the percentage of roots spoiling is always very low.

685 - **Gum-yielding Plants of Brazil.** — MONTANDON HEITOR, in *Chacaras e Quintaes*, VIIIth Year, Vol. XIII, No. 6, pp. 417-421. São Paulo, June 15, 1916. RUBBER, GUM AND RESIN PLANTS

Brazil possesses various indigenous plants which can supply a substitute for gum arabic, obtained, by incision, from several species of *Acacia*, which are: 1) the different species known as "angico"; "angico" proper (*Enterolobium elliptícum* (*Pithecolobium gummiferum*), occurring very widely

in the States of San Paulo, Minas Geraes, Bahia and in the vicinity of Goyaz and Pernambuco; 2) " arvore da gomma " or " gomma lagrima " (*Vochisia gummifera*), is very common in the province of Rio de Janeiro; 3) the " vinheiro do campo " or " arvore do vinho " (*Vochisia thyrsoidea*) common in the State of Minas Geraes.

The best quality " gomma lagrima " (*i. e.* without impurities) is perfectly colourless and transparent; it dissolves completely in 11 parts of cold water and then furnishes a gum which is likewise colourless and transparent. Its specific gravity is 1.604 at 26.25° C. On analysis the following results were obtained:

Composition of Brazil " Gomma lagrima ".

Water	117.99 ‰	Resinous substance	0.43 ‰
Arabine	876.74	Insoluble matter	0.12
Yellow bitter substance	0.31	Ash	4.4%

According to experiments conducted in 1884 by Prof. J. J. PIZARRO at the University of Rio de Janeiro, the gum of *Vochisia thyrsoidea* has an adhesive power 10 times greater than that of gum arabic. With respect to its medicinal properties, it is also fully able to bear comparison with the latter.

From 1900 onwards some consignments of Brazil gum were exported to Liverpool and to Germany, where they were greatly appreciated both on account of their good quality and their low prices.

IMULANT, ROMATIC, ARCOTIC MEDICINAL CROPS

986 – **Tobacco-Growing in Portugal.** — SONTO MAIOR J., in *Boletim da Associação Central da Agricultura portuguesa*. Year XVIII, Vol. XVIII, No. 2, pp. 53-58, 1 fig. Lisbon, February 1916.

Tobacco-growing was introduced in Portugal in 1884, with the object of mitigating the crisis produced in the region of Douro by the phylloxera invasion. It was at first allowed by way of experiment for a period of 3 years, but subsequently the concession was constantly renewed. By decree of 1907 the State tobacco monopoly was granted by public sale to the " Companhia dos Tabacos " which was compelled to pay over to the State 65 % of its profits and to buy from the Douro growers the whole of their product up to 20 % of the total consumption. The growers deliver the tobacco in the form of strung leaves dried to 25 % of moisture. The Tobacco Company pays for it at its market value, which for ordinary unspoilt tobacco is mostly 18 centavos (4 ¼ *d.*) per lb. Furthermore by decree of the 2nd February 1891 a premium of 10 *centavos* (2 ½ *d.*) was granted for every pound of tobacco delivered in good condition. The average production per acre is 8 922 to 12 490 lb. of dry leaves. Home-grown Portuguese tobacco is used for manufacturing cheap cigars. In comparison with other European tobaccos it is of mediocre quality.

During the thirty years for which tobacco has been cultivated in Portugal the plant has hybridised naturally, has subsequently undergone selection and has become fixed in the type best adapted to the climatic and soil

onditions. Although the growers played no part in all these operations, ortuguese tobacco is to-day, according to the writer, in such a position hat its intrinsic quality is incapable of further improvement; on the other and, the methods of cultivation might be much improved.

57 - **Cultivation and Selection of *Vitis rotundifolia* and *V. Munsoniana* (Muscadine Grapes) in the United States.** — HUSMANN GEORGE C. and DEARING CHARLES, in *U. S. Department of Agriculture, Farmer's Bulletin* 709, 28 pp., 29 fig. Washington, D. C., April 1st, 1916. VINE GROWING

The vines called "Muscadine" in the United States are native and arive (under suitable conditions of soil and climate) throughout the 'seaoard plain in the South-east of the Union, from James River to Florida, s far as the Blue Ridge mountains, and from Florida along the coast of ie Gulf up to Texas; towards the north along the Mississippi up to Southist Missouri and the river Tennessee. In this zone about 25 million acres least (of which a large part at present is uncultivated) are perfectly lapted for the growing of these vines. For some time now the "Muscane" vines have been more widely cultivated than all other stocks over large part of this territory, but it is only during the last 10 years that their oduction has attained to any real commercial importance. Of the two ecies which bear the name of "Muscadine" the more important is *Vitis undifolia*. It comprises the most widely grown stocks (Scuppermong, ish, James, Flowers, Thomas, and Eden), and is indigenous in the whole the above mentioned zone. *V. munsoniana* is if anything one of its subopical varieties, and is native to Florida, the coast zone, the Gulf of Mexico id perhaps to the region adjoining the south-eastern coast of Georgia. . *rotundifolia* has small bunches made up of big grapes with big stones. . *munsoniana* has comparatively large bunches with small grapes and all stones. Furthermore, it tends to produce continually, and in August bears buds, flowers and fruits in all stages of development.

The "Muscadine" stocks are reproduced by seed or are multiplied slips or layers. The last method is most in use. Grafting which does t give very good results, is rarely resorted to. The most commonly grown rieties have practically a sterile pollen, although their flowers are hermaodite. Cross pollenation with vines having exclusively male flowers therefore necessary. Such is the case with 75 % of the wild vines. It has en clearly established that these vines are entomophilous. Formerly ild vines grew in sufficient number to guarantee annual cross-pollenation. t present the number is much less, therefore the vineyards have to be lanted with them to the extent of one to 8 or 10 fertile vines. It would e highly desirable to place bee-hives in the middle of big vineyards. hile, under natural conditions, from 7 to 10 % of the buds of "Muscane" stocks produce grape bunches, if they are carefully pollenated the roportion producing them is from 20 to 30 %.

As the average production for 4 year old stocks from 1200 to 1430 s of grape per acre may be reckoned; for 5 year old stocks from 2410 to 570 lbs per acre; for stocks in full bearing from 4550 to 7226 lbs.

About 3/5 of Muscadine grape are used for wine-making, especially

the fruit of the varieties the grapes of which fall when ripe, and which are gathered by spreading cloths beneath the stocks, or shaking the latter, and afterwards separating the grapes from the impurities (leaves, branch débris, etc.), by means of a fan. These grapes fetch on the avrage from ½ *d.* to 1 *d.* per lb. On the other hand, the varieties from which the ripe grapes do not drop are cropped by gathering the grapes; their fruits are sometimes eaten as table grapes and feteh a slightly higher price than those above referred to, but they cannot stand lengthy transport. Excellent jellies, jams and syrups, etc., are made with " Muscadine " grapes.

The United States Department of Agriculture is at present engaged in experimental selection of Muscadine stocks with the object of producing varieties possessing: 1) better adhesion of the grape to the bunch; 2) larger size of the bunch; 3) a higher sugar content; 4) less acidity; 5) a better pulp; 6) smaller and fewer stones; 7) a finer skin; 8) uniform ripening; 9) self-fertilisation. A large number of excellent seed plants and several much esteemed varieties have already been obtained. A group of 49 nurseries has been established, where 50 % of the plants show perfect flowering and self-pollenation, and where there is not even a single sterile male plant. Hence the belief that the complete realisation of the objects in view is a question of time has become a conviction. Furthermore, a number of highly promising hybrids have been obtained between the Muscadine stocks and the American *Euvitis*, and between the Muscadines and the *Vinifera*.

The Muscadine stocks are remarkably exempt from diseases and insect pests. The most serious disease is " blackrot " (*Guignardia Bidwellii*) which, in unfavourable years, attacks the flower buds and the leaves, but to a far less serious extent than in the case of *Euvitis*. Control measures consist in spraying with Bordeaux mixture.

Among insect pests, mention must be made of the grapevine flea beetle (*Haltica chalybea*) and an unidentified coleopteron (snout beetle); the damage hitherto caused by them, however, is insignificant.

ORESTRY 988 - **Relations between Forest Valuation and Management.** — FREY P., in *Zeitschrift für Forst- und Jagdwesen*, No. 12, Berlin, 1915.

Adherents of the theory of the net produce of the soil base their calculations of forest value on the determination of " expectation values " as regards such forest stands as the forest is capable of producing. In drawing conclusions from their results they take as their basis the " expectation value of the soil " resulting from the yields stated in money which in theory a soil devoted to forest cultivation is capable of furnishing after deducting the expenses of cultivation. They classify as being theoretically most advantageous to the forest owner that method of working which allows of reckoning on the highest sum as the " expectation value of the soil ". Although they recommend that a low rate of interest be adopted, they leave it to the free discretion of the forest owner to choose the rate, which is the factor influencing in the greatest degree the result of the computations.

The great disadvantage presented by this method is that the most advantageous mode of working does not coincide with the maximum amount

ound for the " expectation value of the soil ". As valuation of the forest nd management should correspond in their results, the writer recommends ie abandonment of the theory of " expectation values " in favour of an- ther method of calculation.

On the method here advocated only the present exchange values (com- on values) of the plants have any influence on the result, and the method termed " method of the exchange values ". It gives much more reliable sults, although the values are only approximate and depend on the laws supply and demand.

The value of the soil on which the stands grow does not in any way form standard of guidance as regards the most judicious mode of working, and nsequently cannot he taken into account in this question. The value of ie initial material alone plays a decisive part in the installation of the fo- st management, because it is the fluctuations in this material which give se to those in the annual growth of the stand. Tabulation of the annual crement (tables of return) is the best basis on which to decide as to the ethod of working to adopt. These results may serve as a reliable basis ith a view to the management of the forest.

The science of forest management should furnish guidance as to ie course to be pursued in determining the initial material, and the average nnual growth. According to the writer, the determination of the value f the standing timber and growth should not be effected by measurement, being sufficient to calculate these values by the aid of properly compiled bles. When the average figure representing the total annual growth of orkable wood, and also of secondary material and underwood, has been termined by means of the tables of yield, and it has been ascertained that is total growth can be utilised uninterruptedly without diminution in the itial material, the task of practical management of the forest is solved. The riter already demonstrated in 1888 and 1889, by means of an example of erage annual yield expressed in money, that the determination of this lue is practicable. It need hardly be said that the same mathematical monstration may be effected where yields by volume are in question in- ead of money yields.

The utilisation of the tables of yield by volume allows, by simple lculation, of determining the necessary bases for the management of ie forest. First there are calculated the total annual yields of workable ood as well as secondary material and underwood then the material re- uired for the durable working of these annual yields, and finally the eco- omic age.

If the period of rotation to be selected is designated by x, and if Zx de- otes the total annual growth per acre of workable wood, secondary ma- rial and underwood corresponding to such period, and Mx the normal ma- rial of workable forest and underwood per acre, the equation $Mx = \frac{Zx \times x}{2}$ obtained. All the oldest plants in a class of management for which the riod x must be maintained, must be deemed workable in view of the fact at their felling yield exceeds the minimum amount; all the youngest

stands, the felling yield of which remains below the minimum amount, must on the contrary be regarded as not yet workable. Consequently, all the youngest stands will be entered in account not at their ordinary felling yield, but in the form of a product obtained by multiplying the total annual growth of workable material by their respective ages.

If the forest owner expects from his forest not only as high and valuable as possible a yield of standing bulk, but also a maximum financial yield, it is sufficient if management, instead of being based on the tables for yield by volume, is based on tables of money return.

LIVE STOCK AND BREEDING.

BREEDING

989 - **The Detection of the Prepotency of Sires.** — HOVER J. M., in *The Journal of Heredity*, Vol. VII, No. 4, pp. 173-178. Washington, D. C., April, 1916.

The superiority of a parent or a breed in determining the character of its offspring is termed "*prepotency*". This character only occurs in very few animals of each breed, and was studied by the writer in the Guernsey cattle in the United States, making use of the herd-book instituted for this breed by the American Guernsey Cattle Club.

Sires having the power of producing improved offspring are generally detected by an examination of the progeny, sometimes a long time after the death or slaughter of the sires themselves.

In order to determine the character of improvement exhibited by a sire, the number of his progeny admitted to registration in the herd-book may be taken as a criterion. The writer rejects this method on various grounds, especially in the case of the American Guernsey breed, owing to the facility with which an animal may be registered, the conditions of admission not being sufficiently stringent (all that is required is the production of 360 lb of butter-fat for a full grown cow, while the average production is 312.771). He likewise rejects the method which consists in comparing the daughters of different sires with their respective dams and noting the amount of improvement. He therefore takes as the criterion of the prepotency of a bull the number of the latter's daughters which produce a very high yield of fat, or, in the case of the Guernsey breed, 600 lbs per year at the time of full growth, and he furthermore introduces the idea of the "equivalent of 600 pounds", that is to say of the young cow, which according to its present production, will probably yield 600 pounds at the age of 5.

In December 1915 there were only 32 bulls which had sired 3 or more daughters with a production equivalent to 600 pounds of fat. This number is very low, representing only 0.092 % of the males registered in the herd-book of the American Guernsey breed. The writer therefore concludes that prepotency is very rare, being found in only 1 per 1000 of the Guernsey breed of bulls.

The writer next studied the ancestry of these 32 bulls which clearly exhibited a prepotent character; he found that with the exception of 3 they all belonged to 7 families, which therefore clearly presented a prepotency

ch family had sprung from an ancestor which had transmitted its pre-ency to a number of its descendants. He further concludes that the char-er in question is probably increased by in-breeding, although some Amer-n prepotent sires are the result of crosses between members of different potent families.

- **A Sex-limited Colour in Ayrshire Cattle.** — WENTWORTH EDWARD N., in *Journal of Agricultural Research*, Vol. VI, No. 4, pp. 141-147. Washington, D. C., April 24, 1916.

In the Ayrshire breed the coat is generally red and white, nevertheless the United States animals of black piebald colour have been observed m time to time (1). Up to the present day, no attention has been paid the mode of transmission of this coat, because in America it was consider-as being undesirable and it was sought to eliminate it by selection. It lifficult to ascertain whether the black is due to a true black pigment, or ether it is simply a very intense red. Under the microscope, typically ick granules appear to be present, but no attempt has yet been made to tain a chemical solution of the pigments.

The writer, for his studies, had recourse to the pedigree (ancestors d descendants) of the Ayrshire bull of the scientific Agricultural Station Kansas, with white and very dark mahogany red coat (called above black ebald). 63 individuals were taken into account altogether. After clas-cation and discussion of the results, the following conclusions are arriv-at:

1) The black piebald colour is a simple allelomorph of the red pie-ld colour in Ayrshire cattle.

2) In the males, the black piebald character is dominant ; in the nales the red piebald character is dominant.

3) Males heterozygous in respect to the two characters have black ebald coat, while heterozygous females have red piebald coat.

Appended is a bibliography of 4 works.

- **Encouragement of the Breeding of Small Livestock and Bee Keeping by the Prussian State Railway Administration.** — BADERMANN, in *Deutsche Landwirtschaftliche Tierzucht*, 20th Year, No. 20, pp. 159-160. Hanover, May 19, 1916.

STOCK RAISING: ORGANISATION AND ENCOURAGEMENT

In 1906 it was proposed in the Prussian Diet to place a sum at the dispo-l of the State Railway Administration for distribution to minor officials id workmen already possessing hives or desiring to obtain them. In 1907 e proposal was carried into effect and the Railway Administration was also commended to make provision for bee-keeping when planting trees and dges on slopes and to arouse the interest of workmen and employees in e-keeping by means of lectures and the distribution of suitable publica-ons. The Railway Administration was furthermore authorised to give nancial and moral encouragement to the purchasing of hives, and it facili-ted attendance to lectures and bee-keeping exhibitions by workmen and ployees.

(1) See *B.*, 1915, No. 1063.

Table I gives particulars of the encouragement granted during t period 1907 1910.

TABLE I.

Years	Amount of grants	Number of workmen and employees who benefited by these grants	Number of workmen and employees who followed courses of lectures and attended agricultural exhibitions	Number of work and employee engaged in bee-keepi
	£			
1907	653	165	208	2 343
1908	552	165	»	2 409
1909	602	—	199	2 511
1910	637	—	»	3 002

In order to improve the economic condition of the workmen and mi officials, especially those residing in the country, in view of the succ of the experiments previously carried out, the Railway Management was advised to encourage small-livestock breeding (goats and rabbits) in ac tion to bee-keeping. With this object, in addition to the measures mentio above for bee-keeping, the following were proposed : to get the workm and officials to join the livestock-breeding associations ; to interest lab organisations in these questions ; to subsidise the construction of suita pens and rabbit-hutches.

Table II furnishes indications as to the encouragement granted in t new period.

The total number of persons engaged in bee-keeping and raising above livestock is therefore 87 902, a by no means contemptible fig from the point of view of the production of milk, meat and honey dur the war. No data are available as to the number of goats and rabbits as to the quantity of animal products obtained. The number of hi was 26 846 at the end of 1914.

TABLE II.

Years	Grants for the purchase of			Number of persons receiving grants for			Number of workmen who attended lectures	Number of workm breeding		
	bees	goats	rabbits	bees	goats	rab-bits		bees	goats	ra
	£	£	£							
1911 . . .	—	£815		—	432		1 292	3 674	42 176	
1912 . . .	10 31	12 34	13 07	500	488	1 500	—	—	—	
1913 . . .	14 28	17 53	12 54	565	628	1 809	—	4 960	30 654	3
1914 . . .	10 86	16 29	15 80	505	1 225	2 093	—	5 367	31 879	5

The figures for the year 1915 are not yet known.

To sum up, the total subsidies allowed from 1907 to 1914 amount to £34 for bee-keeping; £5140 for goat breeding and £4172 for rabbit breeding.

The Adaptation of Different Breeds to the Livestock Industry in the United States. — WENTWORTH E. N., in *The Field*, Vol. XXVI, No. 6, p. 501-503, 542, 544, 546. New York, June 1916.

The adaptation of a breed of livestock to different agricultural conditions depends inversely on its degree of specialisation with a view to a given purpose. The result of this is a restriction of adaptation which practically terminates the distribution of the different breeds. Those breeds which are most perfectly specialised predominate in specific localities, while those which have least deviated from the original conditions of non-specialisation are the most widely distributed throughout the agricultural regions of the globe.

Cattle. — The Shorthorn breed has been the principal source for the improvement of beef cattle. Cattle intended for dairy production in New England and Longhorn cattle in Texas received their first impetus by the heritance of the characters of this pioneer in cattle improvement. In the blue-grass region the descendants of the Durhams have found the best environment, and the Shorthorn breed has since then become and remained the principal breed in the corn belt and the one preferred by farmers.

In the West and South-West of the United States, the first impulse towards the replacement of livestock of mixed breed and Mexican livestock likewise arose through the introduction of the Shorthorn; the development of the meat industry in Argentina is closely linked up with the spread of the Shorthorn; and so is that of Australasia, in the proportion of at least 50 %. The high degree of adaptation of this breed has resulted in its becoming, so to speak, the vanguard which prepares the way for the introduction of other more highly specialised breeds. This is what took place in the corn belt, where the value of the lands requires the quickest possible growth and early maturity.

The Aberdeen-Angus, with its splendid body, its early maturity and economy in feeding, enabled a fresh margin of profit to be secured; nevertheless, the Shorthorn still retains its popularity, as is proved by data showing distribution, which are largely in its favour. The Aberdeen-Angus furthermore proves that it possesses in the highest degree the quality of a show animal in competitions with a view to obtaining very high-class products at shows and exhibitions. At the last international exhibitions, ten live champions and fourteen killed champions belonging to this wonderful breed gave fresh its proof of its superiority.

In those belts where forage production is unlimited, but where there is little grain growing, the Hereford breed has gained the upper hand over the Shorthorn, and has been substituted for the latter in the prairies of the West.

In the pasturage belt of the North and the cold region of Alaska, the Galloway breed has demonstrated its great powers of resistance and its

superiority over all the other selected races in surmounting unfavourable environmental conditions.

Among other breeds, the Polled Durham and Polled Hereford prove their efficacy in the improvement of ordinary cattle by the rapidity with which shortening of the horn is produced by crossing ; the Red Poll breed has also asserted itself as a good dairy animal with good fattening qualities as is proved by the carcasses of this breed shown at exhibitions, and it has thus established its right to exist as a dual-purpose breed. Other breeds like the Devon, have not yet received that final sanction of practice which enables them to be regarded definitively as excellent.

Naturally, the dairy breeds, in order to stand their ground, have had to compete with the Shorthorns and Devons imported by the first colonists ; consequently the progress of dairy breeds generally has, with the exception of some rivalry between the Holstein-Friesians and the Jerseys, been confined to the undertaking, almost in co-operative form, of the conquest of the land occupied by the red, white and roan cattle. The very fact, however, of the varied distribution of the races establishes differences between them as regards their adaptation and intrinsic value, which differences are not always admitted by their partisans. The privileged position gained by the Holstein-Friesian breed in the belts surrounding big towns is a testimony to its great production of milk for sale, just as the fact of wide distribution of the Jersey breed in the South tends to prove its greater resistance to the hot climate. The persistance of many able farmers in maintaining the Jersey breed on certain model farms establishes the quality of its products and its ability for economical production under the most intensive working conditions.

The merits of the Ayrshire and Guernsey breeds are comparatively less popular in the United States. The Guernsey breed, in the belt where it is favoured, has already stood the test as a rival of the Holstein-Friesian and also as a competitor with the Jersey in the capacity of a breed capable of economically yielding a product of superior quality. The Guernsey breed to a certain extent possesses the general characters of the Shorthorn breed for butcher's cattle, and no doubt it would have formed the intermediate link in specialisation if the demand for a highly specialised breed had not arisen too rapidly for the Guernsey to gain a footing. The Ayrshire breed, on the other hand, possessed the advantage of its nationality during the early periods of Canadian colonisation, when many Scottish colonists settled there, and had gained a footing in the rather cold regions of the New England hills for the production of milk in a somewhat greater quantity than that of the Jersey and Guernsey breeds, the quality being almost equal.

Finally, each breed possesses its clearly recognised advantages. The Holstein-Friesian, as a good producer of milk and fat, has gained noteworthy success in the hands of the ordinary farmer specialising in milk production. Its special ability to consume large quantities of bulky foods, which allow of a considerable reduction in the consumption of concentrates, and its qualifications for giving good results in rearing calves intended for meat

oduction, render it essentially the dairy cow for the farmer at the head of non-specialised farm.

The qualities of the Jersey breed are well known. The characteristics e the richness of the milk in fat, economy of production and beauty of pe, which render it the favorite breed for competitions and shows. Owing this it was not long in becoming the favourite breed on big farms, and it is thoroughly stood its ground after a trial of three quarters of a century. t shows and at tests of fat yield it has maintained its position as first in nk among the dairy breeds, so that in the public mind the name of the rsey breed is associated with the idea of every improvement in milk proction.

The Ayrshire breed owes its favour to like qualities. Being the hardit among the dairy breeds, and also exhibiting lines of great beauty, it is become the dominant breed on the Pacific Coast owing to the uniform- of its products. Its constant breeding true to type, as well as the uantity and quality of the milk throughout its offspring, form its principal erit. Probably it possesses in a latent form the necessary qualities for rther specialisation, but hitherto this race has not been subjected as systematically as the others to comparative tests with a view to accurate termination and increase of its productive qualities.

The specific quality of the Guernsey breed as a market milk producer shown by the fine yellow colour of the milk, this colour being highly apeciated by consumers. The breed, however, possesses other and far surior qualities. Its milk production, as compared with the Jersey breed, also higher, and the fat content of the milk is likewise greater than for e Ayrshires and the Holstein-Friesians. It is gaining ground annually th a large number of milk producers, above all those in charge of nonecialised farms.

Horses. — As regards horses, events in the United States have been mewhat similar to what has occurred with cattle. The American trotter, er attempt to increase of speed over a century, continues to be selected tside the breeding of the American farm horse. To-day the original races ly exist for the production of mares intended to be crossed with heavy aught stallions. The breeding of the American thoroughbred trotter is importance henceforward to sporting circles, and that of the light draught rse has to-day disappeared from the most advanced agricultural regions, ving place to the heavy draught farm horse.

The Percheron was the first to introduce on a large scale the proportions the heavy draught horse among American farm horses. It was particularly apted for that task, owing to the comparative lightness of its skeleton, its gorous blood, and its marked qualities for increase of weight. It occupied, America at least, the same place in respect to horses as the Shorthorn eed did for cattle. Its principal merit consists in having given weight its descendants and thus complied with the general demand of farmers.

A striking contrast with this development is afforded by the more speialised labouring horses, such as the Clydesdale, Shire and Belgian breeds. he Clydesdale breed was imported practically at the same time as the Per-

cheron, and has stood the test in all attempts at breeding specialised race without however succeeding in imposing its type on the farm horse, becau it is a type too specialised in the direction of the heavy draught horse, ar the first breeders, who were unable to discern the requirements of intensiv feeding in the foals of this breed, had some failures, because the Clydesda was produced for a single purpose only, and it should either be a heav draught horse or not exist. The Shire race also had similar failures at t outset.

Nevertheless, when breeders had mastered the breeding metho enabling the desired type to be secured with certainty, utilising the e perience gained with the Percheron, they decided to repeat the trial with t Clydesdale, the Shire and the Belgian horses, with ultimate success. T Belgian horse was the last to breed out, and in fact has only done so durin the last five years, when, from the point of view of export, it gained suc importance as to play a part in horse-breeding in America, but its rap spread in the corn belt and the enthusiasm with which it was received the render it clear that the only limit to its further spread lies in the number available sires.

As regards the individual qualities of these breeds, the Shire undoub edly possesses the maximum pulling energy per individual, while the Cl desdale is more perfect in its outlines and action, endowed with longer li and less subject to disease; the Belgian offers a special resistance to co tinuous daily work, though it is not so active as its English rivals; the Pe cheron finally is the best adapted for crossing with the American workin horse.

Pigs. An evolution similar to that undergone by cattle and hor breeding is also observable in pig breeding. The Berkshire played the pa of the Shorthorn. In Canada and the Middle Atlantic States it is the pr eminent meat producer. Along the Pacific coast and in South and Easter America it represents almost exclusively the improved breed imported fro the West. In New England it rivals the Chester White in popularity, whi in the corn belt it is run close by the Poland China and the Duroc Jersey.

These last two breeds form the dominant element in the region whic specialises in pig-breeding. The Poland China was not slow in establishin its claims owing to its early maturity, fattening qualities and possibilit of profit on an economic basis. It had a close rival in the shape of the Du roc Jersey, which is superior to it in fertility, adaptation to pasturage an general hardiness. The two breeds have made progress partly owing t the absolute contrast between them, and tendencies to obtain the extrem forms of each type, which extreme forms are termed "hot bloods" an "cold bloods". From the point of view of adaptation, the Chester Whit was able to spread to advantage in some regions of the United States, an the principal quality of the Hampshire breed as regards meat productio may in the future secure this race a greater popularity. The Yorkshir and Tamworth breeds, which are good for bacon production, are more rarel met with, and the localities where they have adapted themselves a less frequent, their merit being nevertheless genuine and easily observed i

e districts of Ontario, Quebec and New York, as also in Michigan and Min-sota.

Sheep. — In sheep breeding, the Shropshire and Hampshire breeds are ie most widely found, being appreciated both on small farms, ranches and tensive sheep pastures. The former breed is valuable for its fleece, the tter for its weight. The Oxford requires more abundant pasturage; the outh Down is the classic meat producer; the spread of this latter breed is so due to its size and its splendid fattening powers; there are very few eeds which can dispute its supremacy as a show animal, or for the butcher. he Dorset breed has gained favour with some breeders, chiefly owing to s capacity to produce lambs during the winter period, and its good milk oduction.

The fine wool breeds, Rambouillet and Delaine Merinos, have had to ve way to meat breeds in the agricultural region where land is dear; on ie great prairies, however, they still form the basis of big flocks, owing to ie value of their wool and their remarkable herding instinct. The Lin-oln and Cotswold are still very much in demand for the purpose of crossing ith the two above breeds, owing to their great size and to their precocity nd abundant wool production. The Leicester and Cheviot breeds are li-ited to the northern climate and find particularly favourable conditions i Ontario.

The factors limiting the spread of the Cheviot breed are its size and its ndeveloped herding instinct. Nevertheless, after the South Down, this ace possesses the best type of carcass, but the possibilities of its extension irough the region of the Apalache mountains, and the other mountainous arts have not been developed.

33 - **Horse Breeding in Minnesota.** — *The Breeder's Gazette*, Vol. LXIX, No. 25 p. 1294. Chicago, June 22, 1916. HORSES

A "Report of the Horse Breeding Industry in Minnesota" issued by he "Minnesota Stallion Registration Board", University Farm, St. Paul, linn., shows that 2056 purebred and 1896 grade stallions were licensed to tand in Minnesota this year. This is an increase of 54.7 per cent. of pure-red stallions and a decrease of 14.3 per cent. of grades in the last 6 years. Of the 2056 licensed stallions, 1244 are Percherons, 326 Belgians, 126 French Draft, 93 Clydesdale, 52 Shires, 4 Suffolk, 142 Standardbreds, 23 Morgans, 21 German Coach, 11 French Coach, 5 Hackneys, 4 Shetlands nd 2 American Saddlers. The stallion registration board tends to en-ourage horse development in the State in every possible way. Special rse breeders' meetings are held at various points in the State, judges are rnished for many local colt shows, speakers are sent to meetings of rmers' clubs and short courses, and farmers are assisted in the selection good sires. Special attention is given to considering inquiries pertaining the feeding, breeding and management of horses.

The stallion registration law is vigorously enforced by the board; the cases prosecuted in 1915 for violation of the law were all decided in favour the State, with fines of $ 25 to $ 100.

CATTLE

994 – **Statistical Data as to increased Weight and Food Consumption of the Jersey and Holstein-Friesian Breeds from birth to First Calving.** — HAYDEN C. C., in *Ohio Agricultural Experiment Station, Bulletin* 289, pp. 1-30. Wooster, Ohio, August 1916.

The Ohio Experimental Station has published the result of its researches into the daily increase of the Jersey and Holstein-Friesian breeds from birth to calving. The data were collected at the experimental farm, and comprise up to now: 69 series of individual daily observations up to one year, 51 series up to two years, and 37 series up to the first calving. In addition to the increase of weight, there was also noted day by day the quantity of food consumed and the cost of this food, as well as the total cost of rearing, allowing for the other expenses incurred.

We sum up in the following table the average data in reference hereto:

Breed	Average weight at birth	Average weight at 1 year	Average weight at 2 years	Average weight at 1st calving (26-27 months)	Average daily increase in 1st year	Average daily increase in 2nd year
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Jersey	56	472	758	780	1.1	0.8
Holstein-Friesian. . .	82	564	962	1 076	1.3	1.0

Food consumption during the first year and costs of rearing.

Breed	Milk: Full cream lbs.	Milk: Skim lbs.	Cereals (grain) lbs.	Silage lbs.	Hay lbs.	Maize stalks kg	Pasturage days	Cost of feeding	Other expenses	Total cost
40 Jersey .	465	2 968	597	458	709	40	122	$ 27.75	$ 14.79	$42
29 Holstein	449	2 786	656	580	760	29	128	$ 29.31	$ 14.79	$44.
Consumption of food during the second year and costs of rearing.										
19 Jersey .		87	785	2 426	1 038	254	159	$ 27.12	$ 8.89	$36.
22 Holstein		174	870	2 247	1 419	232	151	$ 29.55	$ 8.89	$38.
Consumption of food and costs of rearing from birth to 1st calving (26-27 months).										
24 Jersey .	469	3 005	1 349	2 870	1 805	291	272	$ 54.51	$ 23.68	$78.
13 Holstein	445	2 835	1 517	2 903	2 215	243	272	$ 58.12	$ 23.68	$81.

An examination of the individual series discloses the fact, which important for practical purposes, that calves born in autumn may be reare to the age of one year at a cost below that of calves born in the spring. Th

ason is that when spring comes the former are already able to utilise sturage to the full for the whole of its duration, while for those born in the ring the period of pasturage coincides largely with the suckling period, d the winter period with that of growth, during which the consumption forage and concentrates reaches its maximum.

The quantity of food consumed corresponds to rations capable of pro-ding the complete normal growth of each individual, and is such that it ay be considered that any economy made in this respect would have im-ded normal growth, and that an increase of the ration would probably ve given rise to an increase of growth in the animal, but at such a cost at its adoption would not be justified.

5 - **Progress of the Holstein Breed in the United States.** — *The Breeder's Gazette*, Vol. LXIX, No. 24, p. 1257. Chicago, June 24, 1916.

The Annual Meeting of the Holstein-Friesian Association of America, ich was held on the 7th June at Detroit, Mich., was attended by 2 683 t of the total number of 8 885 members of this association. During e last financial year there has been an addition of 1 260 life members.

The Herd-Book of the Holstein-Friesian Society of America already tes back 45 years and records the presence in the United States of more an 300 000 pure-blooded Holstein-Friesian animals distributed among 000 owners. A new census of them will be carried out during the next ar.

During the last working year 72 665 animals were entered in the Herd-ok, and the registration of 68 766 transcriptions owing to change of nership was made.

In the Advanced Registry there appears as tested during the last asso-tion year 12 882 cows producing an average of 408 lbs. of milk and 40 lbs of butter fat in 7 days, with a maximum of 35.53 lbs of fat for msby Jane Segis Aggie, and of 1205.09 lbs. of fat in one year for Duchess lark Ormsby (world's record).

The minimum individual production henceforward required for the mpionship is as follows : for mature cows, 44.42 lbs butter in 7 days and 06 lbs in a year; for two-year-old cows, 31.4 lbs in 7 days and 1 200 lbs year.

The meeting adopted resolutions in favour of the association providing the creation of a body of inspectors under its control, instead of relying n those of the State Colleges and experiment Stations.

The distribution of prize money absorbed a sum of more than $ 15 000 ; ertising expenses exceeded $ 25 000.

Furthermore, the meeting approved a resolution in reference to the oduction in the Herd-Book of the 305 days' test, according to the rules orce for the 365 day's test, but independently of this latter. This period sufficient to test the continuance in milk, and the advantage was thus ured of making annual calving possible even in animals subjected every r to a production test.

The annual meeting will in the future be held alternately east and west the 18th degree of longitude, and in 1917 at Worcester.

996 - **The Portuguese Cattle Breeds Barrosa and Maronesa.** — DE LACERDA PIZARRO AGOSTINHO JOSÉ FREIRE, in *Revista de Medicina Veterinaria*, 15th Year, No. 173, pp. 130-134, Lisbon, July 1916.

The Barrosa breed (in the Barros region) belongs to the district of the Minho and part of that of Oporto; the Maronesa race is a native of the district of the Douro.

According to the writer the Barrosa breed in its present state shows cranial characters similar to those of *Bos mauritanicus*, and has very fully developed and large horns.

From a comparison between the two breeds the Barrosa breed exhibits the following features: wider head, horns twice the size and pointed directly upwards from their root; the vertex of the frontal protuberance nearer to the median line; shorter face; smaller size of naso-maxillary suture; the presence of a frontal crest, more prominent orbits. The head is dished in both breeds. The line of the upper edge of the neck, especially in its front part, is concave in the Barrosa and almost straight in the Maronesa. The dorso-lumbar line and the tail insertion are identical; the Barrosa breed has straight or slightly hollowed buttocks, the Maronesa straight or slightly convex ones. The limbs of the Barrosa are finer, as its skeleton is more slender; its meat yield may amount to 65 % of the live weight, which is never reached by the Maronesa. The Barrosa breed has less capacity for resisting heavy labour; it is much more suitable for dairy purposes (cows are found which when in full milk yield from 2.6 to 3.1 gall. of milk per day, with 5 to 6 % of fat). According to the measurements made by the writer, the Barrosa breed presents the following average dimensions:

Length of head	15.74 ins.
Width of fore-head	11.42 ins.
Height of withers	51.18 ins.
Coxoscapular length	60.63 ins.
Circumference of chest	80.73 ins.
Height of chest	31.71 ins.
Width of ribs	18.11 ins.
Maximum width of belly	84.64 ins.
Initial width of pelvis	16.93 ins.
Dactylothoracic index	$^1/_{10}$ to $^1/_{10.8}$ lbs.
Live weight	15.40 to 21.56 lbs.

Therefore this is a breed with dished face, short lines and eumetr (according to SANSON, brachycephalic).

The writer holds that the "Barrosãos" cattle form a true race, in that on the other hand the "Maronesos" are the result of a cross between the Barrosa and Mirandesa breeds. He is led to this conclusion both from

servation of the animals and from the fact observed by him that the product of crossing these two races actually presents the characters exhibited the Maronesos.

— **Experiments in Pig-Feeding carried out by the Experimental Sub-Station of North Platte, Nebraska, United States.** — SNYDER W. P. and BURNETT E. A., in *Bulletin No. 147 of the Agricultural Experiment Station of Nebraska*, Vol. XXVII, Art. IV, 56 pp. (Limited Edition); 31 pp. (Popular Edition). Lincoln, Nebraska, 1915.

Report on experiments in pig rearing in 1912, 1913 and 1914. To allow comparing these results with those already set out in the previous bulletins of the same Station, there were adopted (in all cases where not otherwise indicated) the same unit prices as in previous years, namely:

TABLE I.

Pigs per 100 lbs.	$5.40
Maize per bushel	0.47
Wheat " "	0.70
Barley " "	0.40
Rye " "	0.50
Oil meal per ton	30.00
Butcher's offal per ton	40.00
Shorts per ton	24.00
Lucerne hay meal per ton	15.00
Chopped lucerne hay per ton	10.00
Lucerne hay per ton	8.00

Wintering old brood Sows. — It was desired to make a comparison between a ration of chopped lucerne hay mixed with an equal weight of ground grain, and of feeding the lucerne hay in a rack (*ad libitum*) and shelled maize a trough. Each ration was given to 10 sows from the beginning of November to March (average 121 days) in four consecutive years. It is proved by the average of the four years that 9.9 bushels of maize and 86 lbs lucerne hay, or 8.84 bushels of maize and 495 lbs of chopped lucerne hay are required to maintain a sow weighing 387 lbs during 4 winter months and to increase its live weight by about 95 lbs. The feeding of a light grain ration and of lucerne hay *ad libitum* was found to be more economical than the feed with which it has been compared.

Wintering young brood Sows. — During 5 consecutive winters gilts were given *ad libitum* a mixture of 1 part by weight of chopped lucerne hay with 2 or 3 parts of grain. The proportion of grain was reduced when the sows looked like becoming over-fleshy. Each group comprised 20 to 25 sows. The experiments began about the 10th November and ended about the end of March or beginning of April, a little before littering. There was found on the average:

TABLE II. — *Wintering cost of young Sows with farrow.*

Weight of sows at the beginning of experiment	178 lbs
" " " at the end " "	300.3 lbs
Average daily increase per head	0.91 lbs
Cost of feeding to produce 100 lbs of gain in weight	$5.30

To produce 100 lbs of gain, 477 lbs of grain and 181 lbs of alfalfa wer required.

The net wintering cost of a young sow was less than that of an old sow because the former shows a more rapid increase of live weight.

Cost of feeding the porkling from birth until the time when it reached th weight of 50 pounds. — A comparison was made between porklings born o 18 old sows and others born of 24 young sows. The particulars of Table II are the average of a period of 4 years for the former and 5 years for the la ter. The porklings were debited with the cost of feeding of the sows fro autumn to the time when they weighed 50 lbs (end of the experiment), plu the cost of feeding the porklings from weaning until the end of the exper ment. The difference between this total and the value of the increase o live weight of the sows during the period of experiment forms the cost o production of the porkling weighing 50 lbs.

TABLE III. — *Average Cost of Porklings weighing 50 lbs.*

	Born of old sows	Born of young sows
Increase in live weight of sows during period of experiment . . .	62 lbs	101.1 lb
Cost of feeding sows and porklings.	$17.41	$16.1
Number of young born at each litter	11.1	9.2
Weight of young at birth	2.4 lbs	2.31 lb
Number of porklings which lived to the end of the experiments . .	6.55	6.2
Age at which the weight of 50 lbs was attained	89 days	101 day
Cost of food consumed for the production of this weight	$2.11	$2.03

Comparison between the cost of production of the autumn-born porklin and the spring-born porkling. — For 4 years a comparison was made betwe 579 spring pigs born from old sows, 543 spring pig from young sows, and 7 autumn pigs from young sows. Their average costs of production (from th moment immediately preceding littering until the time when the porklin reached the weight of 50 lbs.) were $2.05, $1.81 and $2.03 respectivel As compared with the old sows and their porklings, the young sows co sumed less grain. They reared nearly as many young, and the latt increased in live weight with an almost equal rapidity.

ABLE IV. — *Comparison between the cost of pigs from old sows and those from young sows.*

	From old sows	From young sows
om autumn to the time when the porklings weighed 50 lbs . .	$2.11	$1.68
om immediately before birth until the above time	$2.01	$1.51

The young sows produce the porklings at a cheaper cost, above all cause, being less in bulk, they require a smaller maintenance ration, and ey and their young convert a larger proportion of the food into increase live weight.

Cost of rearing pigs on lucerne pasturage supplemented by a grain ration, ring the summer. — The observations bore on 1 345 pigs divided into 50 oups. The results show that the rate of increase of live weight is closely nnected with the quantity of grain consumed, and that the cost of the crease of live weight rises with the rate of such increase. The lucerne sture is cheap and the grain ration is expensive. The increase in live ight is cheap or dear according as it is produced principally by the for- r or the latter means. A ration of less than 2 lbs of grain per day per 0 lbs of live weight may produce pigs poor in growth. The average of e results is set out in Table V.

TABLE V. — *Rearing pigs with lucerne pasturage and grain.*

Daily ration of grain per 100 lbs. of live weight	Daily increase of live weight per head	Quantity of grain consumed to produce 100 lbs. increase in live weight
2 lbs	0.50 lbs	260 lbs
2.5	0.73 lbs	312 lbs
3	0.80 lbs	384 lbs

Shorts for pigs kept during summer on lucerne pasturage. — A supplementary ration of maize alone (grain) is compared with another ration made of $^3/_4$ maize and $^1/_4$ shorts, and yet another ration made up of half maize d half shorts. In the first case, the ration of maize alone produces somewhat more rapid increases of live weight at a slightly less cost ; in the second se, rather better results were obtained with the ration of maize and shorts t the difference was always small. It is not desirable to replace maize by orts if the latter costs no less than the former.

Dry or soaked maize for lucerne-pastured pigs. — Soaking the maize ins does not give any advantage.

Food consumed during summer by boars. — A ration of 2.5 lbs of grain per day was fed per 100 lbs of live weight to lucerne-pastured boars. They consumed 339 lbs of grain per 100 lbs increase of live weight. The increase of live weight per head per day was 0.92 lbs. ; at the end of the autumn the pigs weighed on the average 171 pounds each.

Maize and supplementary feeds for pig fattening. — From the 14th November 1911 to the 27th February 1912, the rations 1 to 10 of Table VI were again distributed in the following winter and ration 11 was also tested. Lucerne hay was given ad libitum.

TABLE VI. — *Maize (corn) and additional foods for pig-fattening*

Group	Ration
1	Shelled corn (1911-1912) or shelled and crushed corn (1912-1913)
2	Ear Corn and lucerne hay
3	Ground corn and lucerne
4	Ground corn and lucerne hay
5	Ground corn 90 parts and lucerne meal 10 parts
6	Ground corn 90 parts and shorts 10 parts
7	Ground corn 90 parts and of oil meal (extracted by solvents) 10 parts
8	Ground corn 95 parts and butcher's offal 5 parts
9	Ground corn 90 parts, oil cake 10 parts, and lucerne hay
10	Ground corn 95 parts, butcher's offal 5 parts, and lucerne hay
11	Ground corn 90 parts and cotton seed cake (extracted by cold compression) 10 parts

Results.

Group	Average increase of live weight per head per day		Weight of food consumed to produce 100 lbs increase of live weight		Cost of production of 100 lbs increase of live weight		Profit per pig	
	1911-1912	1912-1913	1911-1912	1912-1913	1911-1912	1912-1913	1911-1912	1912-1913
1	0.78	1.22	610lbs	494lbs	5.13 $	4.19 $	0.64 $	2.34 $
2	0.79	1.52	586	424	4.80	3.50	0.92	3.09
3	0.78	1.52	603	446	4.93	3.36	0.80	3.78
4	0.90	1.33	597	482	4.93	3.93	0.93	2.80
5	1.00	1.24	536	497	4.45	4.13	1.53	2.41
6	1.05	1.34	511	461	4.47	4.04	1.59	2.72
7	1.24	1.41	467	445	4.23	4.03	2.20	2.80
8	1.25	1.46	469	441	4.21	3.96	2.25	3.08
9	1.26	1.41	487	455	4.29	4.08	2.13	2.81
10	1.26	1.47	484	447	4.14	4.00	2.35	3.04
11	—	1.48	—	454	—	4.00	—	3.07

Corn and lucerne compared with corn, shorts, and lucerne in rearing nd fattening pigs. — The experiments comprised the periods: 1) from 5th eptember to 14th November 1911; the pigs, of an average weight of 112 12 lbs in the 1st group, and 115 lbs in the 2nd, were put out to lucerne asturage, and were given: the 1st, 3.34 lbs of ground maize per 100 lbs ve weight per day; the 2nd, 3.30 lbs of a mixture of $^2/_3$ corn and $^1/_3$ shorts er 100 lbs live weight per day. The pigs of the 1st group increased in ve weight by 0.05 lbs more per head daily than those of the 2nd group, nd consumed 10 lbs less grain per 100 lbs gain in live weight. 2) From 4th November to 2nd January, the pigs were kept in the sties; they were iven as much lucerne hay as they wanted and 2.48 lbs of maize per 100 lbs of the 1st group. To the 2nd group 2.60 lbs of corn + shorts per 100 lbs were iven; they increased 0.06 lbs more per head daily than the 1st group, nd consumed 2 lbs of grain more per 100 lbs increase of live weight. In the wo experiments together the two additional rations produced the same daily increase of live weight, and 16 lbs more of corn plus shorts were re quired (as compared with corn alone) to produce 100 lbs increase of live weight. At the prices contained in Table I, the profit obtained per head with the additional corn ration alone was almost double that obtained with the additional ration of corn + shorts.

TABLE VII. — *Wheat and rye compared with maize for fattening pigs with or without lucerne hay.*

Ration	Average daily increase of live weight per head	Foods consumed to produce 100 lbs. increase of live weight	Cost of 100 lbs. increase of live weight		Profit per pig	
			(1)	(2)	(1)	(2)
	lbs.	lbs.	$	$	$	$
y Shelled corn	1.11	479	3.97	5.47	2.11	2.49
y whole wheat	1.02	519	5.09	5.98	loss	1.91
aked »	1.05	514	5.92	5.92	loss	1.80
listened ground wheat	1.30	433	5.00	4.99	1.21	3.70
oaked »	1.41	418	4.84	4.84	1.46	4.02
listened whole rye	0.88	558	0.51	5.50	0.34	1.97

(1) Prices taken at Corn 47c, Wheat 70c and Rye 50c per bushel. Hogs $5.90 per 100 lbs. — (2) Prices taken at Corn 65c, Wheat 70c, and Rye 50c, per bushel, Hogs $7.75 per 100 lbs.

Addition of lucerne and residue of lucerne tea to a ration for wintering castrated young pigs. — The following comparisons were made: 1) lu-

cerne hay *ad libitum* + ration of 3 parts of corn and 1 of shorts reduced to a thick slop : *a*) with hot water ; *b*) with an infusion of lucerne hay ; 2) to the above basal ration there were added : *a*) infusion residue, *i. e.* lucerne hay stewed for an hour in hot water, and then drained ; *b*) the same quantity of chopped dry hay ; 3) *a*) ration of 90 parts of ground maize 10 parts of chopped lucerne hay mixed and reduced to a paste with boiling water *b*) the same quantity of corn and the same quantity of infused chopped lucerne hay (solid and liquid parts).

In the first two experiments the use of the lucerne infusion and the in fusion residue proved of advantage ; in the third, it was only slightly so To sum up, this operation cannot be advised in those cases where it would be very expensive.

TABLE VIII. — *Comparison between corn and: corn + shorts; corn + barley corn + Triticum dicoccum ; corn + wheat ; corn + butcher's offal. — Average of all the results.*

	Corn	Corn + shorts	Corn	Corn + barley	Corn	Corn + *T. dicoccum*	Corn	Corn + wheat	Corn	Corn + butcher's offal
Number of experiments made	10	10	8	8	3	3	4	4	7	7
Number of pigs experimented on	168	168	132	132	84	84	64	64	162	162
Daily increase of live weight per head . . . . . lbs.	.94	.94	1.19	1.10	1.33	1.14	1.30	1.22	1.17	1.14
Weight of food required to obtain of 100 lbs increase of live weight . . . . . lbs.	436	433	478	532	477	529	501	470	511	487
Cost of 100 lbs gain of . $	3.36	4.07	4.04	4.48	3.95	4.48	4.01	4.53	4.26	4.06
Profit per pig . . . . . $	1.70	1.34	1.78	1.26	1.95	1.38	2.33	1.71	1.83	1.74

998 - **Specific Effects of Different Rations on the Growth of Pigs ; Experiments at the Ohio Agricultural Experiment Station, United States.** — FORBES E. B., BEACH F. M., FRITZ C. M., MORGAN I. E. and RHUE S. N., in *Bulletin of the Ohio Agricultural Experiment Station*, No. 283, pp. 111-152, fig. Woster, Ohio, 1915.

Experiments in feeding followed by slaughter and analysis of the car casses, carried out in pigs, in order to study the specific effect of ration

he composition of the resulting increase of live weight. The rations indicated in Table I.

TABLE I. — *Rations tried.*

1) Corn (maize) alone.

2) Corn and soya beans) in the ratio 10.82 : 1.

3) Corn and linseed oil meal (extracted with solvents) in the ratio of 9.36 : 1.

4) Corn and wheat middlings, in the ratio 2.81 : 1.

5) Corn and slaughter-house offal, in the ratio 18.84 : 1.

6) Maize and skim milk, in the ratio 0.882 : 1.

7) Control (killed at the beginning of the experiment).

These rations were fed so as to contain the same quantity of digestible er per unit of live weight of the pigs. The feeds supplementing the were added in such quantities that the different rations had the same between protein and starch value as the non-nitrogenous substances. equently this experiment served to a great extent for comparing the ing powers of pigs when they consume equivalent quantities of protein fferent forms. For this purpose 35 pigs, all pure-bred Duroc-Jerseys, used, divided into 7 groups of 5.

It was found that the capacity to produce increase of proteins is greater he digestible protein of milk than for the digestible protein of the vege- foods tried and slaughter-house offal.

The maize with supplementary ration of: soya, linseed oil meal, sharps, t middlings, slaughter-house offal, and skim milk, in such proportions that the nutritive value of the rations was 1 : 6.5, does not furnish ral substances corresponding to what is required for the maximum th of the bones, either as regards the nature or quantity of these substances.

Rations of corn alone, and corn + soya, produce the minimum in point ne growth. Rations of corn + slaughter-house offal and corn + skim milk uce the maximum in this respect. Rations of grain alone do not produce a normal formation of bone.

Among all the groups chosen for the experiment, that which was given corn and linseed oil meal gave the maximum percentage of meat and utaneous and peritoneal fat (on the whole), and the minimum percentage one, as compared with the entire skeleton completely strippedof meat. The groups to which slaughter-house offal or skim milk was given had maximum proportions of bone as compared with the entire meatless ton, with the exception of the groups to which corn alone or corn + soya given, in which the larger proportion relatively to the skeleton was due o a greater development of the bones, but to the inferior nutrition of ther tissues.

The proportions of lime, magnesia and phosphorus in the bone sho a great tendency to remain constant, but they may be modified within c tain limits by the limitations applied in the feeding. Nevertheless, the solute *quantities* of these elements in the bones are capable of a far grea modification as a result of the composition of the feed given.

The percentage of ash and the breaking strength of the bones var on the following decreasing order: 1) maize+skim milk; 2) maize+slaught house offal; 3) maize+linseed oil meal; 4) maize; 5) maize+wheat middlin 6) maize+soya brans. They are set out, in the order of groups, in Table

In all the groups except those which had received slaughter-ho offal or milk, the bones contained less lime and phosphorus than in the c trol group (killed at the start of the experiment). The skeletons of pigs which had wheat middlings (a food very rich in magnesia) contain more magnesia than those of the control group.

The ration of corn alone produced less moisture, protein and ash, a more fat in the meat, than all the other rations of corn+supplementary fo At the opposite end of the series is the ration of corn+skim milk, which p duced the maximum moisture and protein and the minimum of fat in meat.

TABLE II. — *Percentage of ash and breaking strength of bones.*

	Percentage of ash in the bones		Breaking Strength	
	natural state	freed from water	of the femur	of the tib
1	24.1790 %	41.3811 %	198.17 kg	208.65
2	23.8160	38.6059	191.01	180.15
3	20.5020	32.9561	157.58	157.08
4	20.3940	33.2637	154.67	149.73
5	19.0330	34.9358	150.86	144.24
6	19.2560	32.5435	141.52	133.72

There is a great variation, which appears to be caused by feeding, the quantity of the mineral constituents of the meat and blood.

Half of each carcass was salted and treated for preservation. It w observed that the foods had produced great differences in the compactn of the loins and sides, and some effect on their behaviour during cookin together with a slight effect on the good quality of the meat when cooke

A complete analysis of one half of each carcass was made. The resu obtained show the existence of a specific effect on the proportions of the pr cipal parts forming the tissues. The results are shown in Table I

Complete histological analyses of the blood of each pig were ma Certain individual differences were referred to the condition of nutriti of the animals forming part of one and the same experimental grou

er observations were considered as being specific or characteristic of the ıp and the ration.

The quantity of catalase contained in the most important organs and ıes was estimated, and certain differences were noted between the results ıı by the different groups subjected to the experiment.

One of the most important facts resulting from this study and others ioiisly carried out at the same Station (Bulletin 271) relates to the use me in agriculture. It is rendered obvious that cereals are very poor me regarded as an element of the food of animals, as it has been clearly ed that the normal growth of the skeleton cannot be produced by grain. ; calls special attention to bulky leguminous forages ; as they contain eat deal of protein and a proportion of lime which no other forage

TABLE III. — *Effects of the ration on the principal constituent parts of the tissues.*

Ration	Ratios between protein and fats in the meal (ether extract)	Ratios between protein and ash in the bone	Ratio between protein, fats and ash in the carcass
. . . . .	1 : 6.66	1 : 1.130	1 : 5.12 : 0.178
. . . . .	1 : 5.65	1 : 0.957	1 : 4.45 : 0.170
. . . . .	1 : 6.30	1 : 1.139	1 : 4.95 : 0.169
. . . . .	1 : 5.87	1 : 0.928	1 : 4.43 : 0.159
. . . . .	1 : 6.34	1 : 1.171	1 : 4.88 : 0.197
. . . . .	1 : 5.03	1 : 1.171	1 : 3.93 : 0.179
. . . . .	1 : 4.52	1 : 1.076	1 : 3.36 : 0.199

ishes, they form the ideal natural supplementary food to be used with ı. The growth of *Leguminosae* depending on conditions resulting from presence of calcium compounds in the soil and these plants taking large itities of that element from the soil, the normal growth of animals ds in a natural relation to the fundamental question of the use of cal- ı compounds in agriculture.

Wheat as a Food for Fattening Pigs ; Experiments in Missouri, United States (1). — WEAVER L. A., in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Bulletin* 136, 35 pp., 8 fig. Columbia, Miss., 1915.

In 1913 the wheat crop was very plentiful and the maize crop very poor ıe State of Missouri, so that the price obtainable by the farmer for the ıer was less than the purchase price of the latter. The Agricultural eriment Station of Missouri received many enquiries from farmers con-

(1) See also *B.* May 1915, No. 540. (*Ed.*)

cerning the comparative value of wheat and maize as a food in the fattening of pigs, and the best method of feeding wheat to them.

In 1914, the continuous rains at the end of the summer and beginning of the autumn damaged a large part of the wheat harvested in the State of Missouri, and reduced its value to such an extent as to make its use as a pig food economically desirable.

The experiments included numerous and variously combined feeding tests, accompanied by the slaughter of standard animals belonging to each of the group experiments. The purpose of these experiments was: 1) to compare the food value of maize and wheat; 2) to obtain particulars as to the food value of wheat fed alone or together with other foods rich in carbohydrates; 3) to obtain data as to the food value of wheat along with foods rich in protein and mineral substances.

The results are contained in 30 tables and are summed up as follows:

In this experiments pigs fed on wheat increased in weight more rapidly than those fed with maize.

During the entire feeding period of 120 days the wheat-fed pigs showed an average daily gain of 1.25 lbs per head as against 1.00 lbs for those fed on maize.

To produce 100 lbs increase of live weight there was required 483 lbs of wheat as against 582 lbs of maize in the like conditions.

A mixture of wheat and maize in equal parts appeared to be more suitable in point of rapidity and economy of increase of live weight than maize alone, but less than wheat alone.

A ration of maize 10 parts and butcher's offal one part produced more rapid increase of weight than maize alone.

During the 120 days of the feeding period, the ration consisting of 10 parts of maize + 1 part of butcher's offal produced an increase of live weight of 1.27 lbs per head per day, as against 1 lb with the maize ration alone.

To produce 100 lbs increase of live weight a lesser quantity of grain was needed when the maize was supplemented by butcher's offal. In this experiment, 498 lbs of a ration consisting of 10 parts of maize and 1 part of butcher's offal produced the same increase of live weight as 582 lbs of maize alone under like conditions.

The addition of butcher's offal to the wheat ration showed a clear advantage during the first part of the feed test.

During the first 78 days of the experiment, the ration 10 parts of wheat + one of butcher's offal gave an average increase of live weight of 1.55 lbs per day, while the ration of wheat alone produced 1.25 lbs. During that period, in order to produce 100 lbs increase of live weight, there were required 424 lbs of the ration wheat+butcher's offal as against 455 lbs of wheat ration alone.

During the last 42 days of the experiment, the pigs fed on wheat and butcher's offal also showed a more rapid increase of live weight, namely 1.53 lbs per head per day as against 1.26 lbs with wheat alone. This surplus in the increase of live weight was not very, or rather not at all, economic. During this period, to produce 100 lbs increase of live weight there were re-

ained 543 lbs of the ration of wheat alone, or 562 lbs of the ration wheat butcher's offal.

A ration of wheat 10 parts, butcher's offal one part produced more pid increase of live weight than a ration of wheat 5 parts, maize 5 parts d butcher's offal 1 part, or a ration of maize 10 parts, butcher's offal part. Furthermore, the increase of live weight was more economical. a similar way, the ration 5 parts of wheat, 5 of maize and 1 of butcher's fal was more effective than the ration 10 parts of maize and 1 of butcher's fal.

469 lbs of the ration wheat + butcher's offal produced 100 lbs increase live weight at the rate of 1.52 lbs per head per day. 458 lbs of the tion wheat + maize + butcher's offal were needed to produce 100 lbs crease of live weight at the rate of 1.44 lbs per head per day. Finally, 98 lbs of the ration maize butcher's offal were needed to produce 100 lbs live weight at the rate of 1.27 lbs per head per day.

900 - **Egg-laying Competition in Australia.** — I. HART A., Results of the 5th Egg-laying Competition held in the State of Victoria, Australia, in 1915-1916 (1), in *The Journal of the Department of Agriculture of Victoria*, Vol. XIV, Part 6, pp. 329-340, 8 fig. Melbourne, June 1916. — II. THOMPSON D. S., Results of the 4th Egg-laying Competition held at the Grafton Experiment Farm, New South Wales, in *The Agricultural Gazette of New South Wales*, Vol. XXVII, Part 6, pp. 433-437. Sydney, June 1916. POULTRY

I. — One year competition (April 1915-April 1916) held at the Burnley chool of Horticulture, in which 570 hens took part, in groups of 6, divided nto 3 sections: 1) light breeds, wet fed (56 groups); 2) light breeds, dry fed 9 groups); 3) heavy breeds, wet fed (20 groups). The wet fed hens were, the morning, given a mash consisting of crushed oats, sharps, pea meal, at shorts and chopped liver; at noon, the same mash mixed with lucerne nd chopped beetroots; in the evening, a mixture of grain. The dry fed ens received a ration consisting of about the same constituents, but simly mixed together and not reduced to a mash. The difference between he groups subjected to the two forms of feeding was slight, and far less than the preceding year. This proves that dry feeding, provided it is proerly constituted and well balanced, is quite as suitable as wet feeding, nd that the selection of the feeding should therefore be according to the onditions of the locality.

The total number of eggs laid during the year by the 570 hens (20 died efore the end of the competition and were not replaced) was 125 119, of hich 75 900, or about 226 per hen, were furnished by the 336 hens of the st section. The 114 hens of the 2nd section laid 25 164 eggs, or an average f 200.7 per hen.

The 120 heavy breed hens of the 3rd section laid 24 055 egs. or an average of 200.5 per hen.

The light breeds were exclusively represented by the White Leghorn; he heavy breeds by the Black Orpington, Rhode Island Red, Faverolle, ilver Wyandotte, White Wyandotte, and White Orpington.

(1) See also: *B.* 1915, No. 918. *Ed.*

The 3 best groups in each section gave the results indicated in Table I.

TABLE I. — *Results given by the 3 best groups in each section.*

Breed	Total number of eggs laid	Average weight of a dozen eggs
1st Section.		
White Leghorn	1 661	694 gr.
Do.	1 637	661
Do.	1 623	678
2nd Section.		
White Leghorn	1 638	666 gr.
Do.	1 601	616
Do.	1 457	708
3rd Section.		
Black Orpington	1 507	725
Do.	1 447	686
Rhode Island Red	1 423	700

The maximum productions obtained up to the present in Austral in Government controlled competitions are those indicated by Table (number of eggs laid in one year by a group of 6 hens).

TABLE II. — *Maximum production obtained hitherto in controlled competitions in Australia.*

State	Breed	Number of eggs
South Australia	White Leghorn	1 589
West Australia	Do.	1 564
New South Wales	Do.	1 541
Queensland	Do.	1 564
Victoria	Do.	1 699
New Zealand	Do.	1 632
Victoria	Black Orpington	1 562

This last competition also brings out clearly the rapid and contin improvement of the White Leghorn as a laying breed in the State of Victor The winning group of the Dookie College competition in 1904-1905 l 1313 eggs in 1 year; in the last competition, the winning group laid 1 661, a the first 5 groups laid 8 160, or an average of 272 eggs per hen.

II. In the 1 year competition ended on the 31st March 1916 there ok part: *a*) 19 groups of 6 hens in their 1st laying year; *b*) 22 groups of as in their 2nd laying year which had already competed in the previous ar. The breeds represented were: White Leghorn, Brown Leghorn, ack Orpington and Silver Wyandotte.

The year was remarkable for an exceptional drought, and the green od had to be reduced. The hens were given in the morning a hash of arps, bran and flour with a little salt; in the evening a mixture of wheat d maize; liver once a week; crushed shells to any amount; and often somite (natural magnesium sulphate) dissolved in water.

The results were not so good as those of the preceding year. The neral average obtained was 168 eggs per hen against 182 in the preceding ar. The 1st two groups of hens respectively produced during the 1st oductive year 1265 eggs, weighing 680 grms per dozen, and 1227 eggs eighing 708 grms per dozen. During the 2nd year of production, the t 2 groups of hens respectively have 2141 eggs weighing 680 grms per zen. and 2055 eggs with the same average weight. In Table II a compa- on has been made of the results of the last 3 competitions, indicating e average number of eggs per hen in the different months.

ABLE III — *The Results of three Egg-laying Competitions held at the Grafton Experiment Farm. — Average number of Eggs laid per month.*

	1913-1914	1914-1915	1915 1916
April	6.9	9.9	8.2
May	14.3	15.8	7.1
June	11.0	10.4	10.2
July	16.4	15.8	13.8
August	21.3	20.8	16.2
September	21.3	21.0	18.1
October	21.3	21.7	21.9
November	19.2	20.7	16.9
December	17.2	16.9	15.6
January	17.0	11.2	18.3
February	13.2	10.7	13.6
March	10.6	6.6	8.2

Experiments in Breeding different Races of Silkworms. at the Silkworm Station of Puerto de Santa Maria (Seville, Spain). — *Boletin de Información de la Estación sericícola*, IVth year, No. 6, p. 3. Puerto de Santa Maria, June 30, 1916. SERICULTURE

The Table appended sums up the principal results of these experiments.

Results of Experiments.

Races bred	Weight of cocoons obtained from 1 ounce of eggs: normal	constricted	with poorly developed points	Average weight of a cocoon	Ratio between weight of silk of cocoon and that of chrysalis	Pro... pon... of... cons... in... cocc...
Var N° 1	78 653 g	486 g	1 065 g	1.976 g	1 : 5.841 0.3	
Var N° 3	79 215	1 217	821	2.019	1 : 5.838 1.5	
Var N° 5	81 792	420	1 607	2.132	1 : 5.809 0.5	
Var N° 15	76 796	789	1 456	1.759	1 : 4.761 1	
Var, acclimatised in Spain	73 095	1 535	2 184	1.983	1 : 5.218 2	
Ascoli Piceno N° 1	80 886	415	846	2.020	1 : 4.824 0.5	
Ascoli Piceno N° 2	86 280	671	1 049	2.240	1 : 5.415 0.75	
Ascoli Piceno, acclimatised in Spain	76 181	2 504	746	1.910	1 : 5.758 3	
Milan	76 556	3 221	846	2.150	1 : 5.520 4	
Milan, acclimatised in Spain	69 798	3 196	2 214	2.020	1 : 5.350 4.5	
Perusa	68 764	2 041	2 114	2.092	1 : 6.390 2.8	
Fuentes Tijola	62 262	651	1 914	2.040	1 : 5.940 1	
Spanish with black adults	61 632	1 307	1 080	1.987	1 : 6.150 3	
Campocroce Cross No. 1	74 633	4 021	784	1.800	1 : 5.880 3	
Campocroce Cross No. 2	74 717	1 929	382	1.750	1 : 5.660 2.5	
Campocroce Cross No. 3	71 134	1 741	3 429	1.750	1 : 5.330 2.25	

FISH CULTURE.

1002 – **The Migration of Fish of the Genus *Mugil*, in the Lake of Thau** (1). — Roule, in *Comptes-Rendus des Séances de la Société de Biologie*. Vol. LXXIX, No. 11, pp. 503-5 Paris, June 1916.

The complete migration of these fish includes two displacements inverse directions, one outward, from the lake to the sea, the other inwa from the sea to the lake. The outward migration takes place during t second half of the summer (August and September); it is connected w sexual development, the individuals passing out of the briny waters the lake into sea water being chiefly breeding fish, the genital organs of wh are already bulky. Their sexual maturation and spawning takes place sea. The inward migration occurs during the winter and the first half spring, its principal movement lying between February and April. T individuals then passing from the sea water to the brackish waters of lake belong to two categories: one are recently hatched fry from the spa resulting from previous outward migrations; the others are immature adu

(1) See also *B.* May 1916, No. 543.

which may, from their appearance, be regarded as the breeders in the previous outward migrations, who return to the lake after spawning. The *Mugil* thus present the characteristic migratory type which the writer has termed "thalassotoccic"; they normally live in an environment of brackish or almost fresh water, pass out into the sea water for reproduction, then after spawning return to their normal habitat.

In their outward migration the individuals pass from a less salt into a more salt environment, from an environment with higher to one with lower temperature; the opposite is the case however (or, as regards temperature, at any rate there is equality between the two environments) at the time of the inward migration. Apparently, therefore, the differences in relation to saline character and temperature play no predominating part in the phenomenon of migration, since the displacements take place both in the positive and negative direction in reference to these conditions.

This is no longer found to be the case however with regard to dissolved oxygen. The researches of the writer on the outward migration have shown that the sea water of the coast at that time is always richer in oxygen than the water of the lake. In the same way, at the time of the inward migration the saltish water of the lake is richer in dissolved oxygen than that of the sea. In both cases, the two inverse displacements have the common condition of being directed from a less oxygenated environment towards an environment better provided with dissolved oxygen.

The displacement of the migratory fish in both directions does not take place at haphazard, but is connected with the presence and duration of the currents existing between the sea and the lake. At the time of the outward migration the majority of the migrating fish only go to the sea when the sea water currents flow towards the lake, and they pass up these currents swimming against the stream. In the same way, at the time of the inward migration, the principal displacement towards the lake is effected against the current when the waters of the lake are passing to the sea. The whole thing takes place just as if the migratory fish did not decide to travel and accomplish their migration until after they had been touched by waters dissimilar from those in which they had hitherto been, and as if such migration only consisted in their maintaining themselves in this new environment, passing along it by gradual stages until the place from which it has its origin is reached.

These considerations lead to several conclusions bearing on the migration of fish:

1) The *Mugil* of the lake of Thau exhibit a simplified type of reproductive or genetic migration, as they need only travel a few miles to accomplish spawning. This type, however, is complete; the indications it provides for simplification are therefore of great importance, as accessory circumstances to which otherwise one may be tempted to attach great importance did not here come into operation.

2) This reproductory migration, in its two inverse directions, possesses an external determining cause, due to the direct action of the surrounding medium. In order that it may take place, it is essential that the

alternating currents set up between the sea and the lake should exercise a differential excitation on the individuals who have reached the stage of readiness for migration. This migration therefore clearly bears a character of tropism, as the immediate influence of the environment plays a preponderating part.

3) This tropism is chiefly of a respiratory kind, as the individuals, whatever the direction of their movement, always pass from an environment poorer to one richer in dissolved oxygen. These conclusions are not merely interesting with regard to the special case of the *Mugil*. They also bear on several other migratory fish, the journeys of which are longer and more complex. It may be readily assumed as regards these latter that the cause of the migration consists either in a reproductive instinct which forces the genetic individuals towards an environment necessary for the future development of their spawn, or in an inherited memory which would call these individuals back to the ancestral environment at the time of their reproduction. None of these reasons of a psychic character and hypothetical nature could be pleaded with regard to the *Mugil*, the migrations of which, as has been seen, have for their principal cause a tropism of a respiratory character. The writer, from the previous observations the series of which he is now continuing, holds that this cause is likewise the one governing the spawning migration of the *Salmon*.

The method of biological investigation which seeks to establish the curves of variation of the differential circumstances of environments in problems of this kind, and to follow the variations in these curves in order to determine those which constantly agree with the variable and successive dispositions of the individuals is the only one which can produce reliable results. These results are of two-fold importance, scientifically in respect to the theory of migration, and practically with regard to fish breeding and fisheries, provided that they are based on numerous and repeated observations so as progressively to eliminate with certainty all secondary circumstances of the character of mere coincidence. The writer therefore proposes to continue these researches, and to undertake them on a larger scale, in order to arrive at the most precise possible conclusions as to the determining causes of migration.

FARM ENGINEERING.

GRICULTURAL MACHINERY AND MPLEMENTS

1003 – **Production of Agricultural Machinery in the United States in 1914.** – *Farm Implement News*, Vol. XXXVII, No. 25, p. 15, 1 table. Chicago, June 22, 1916.

The Census Office of the Department of Commerce in the United States has published a preliminary summary of the results of its enquiry into the production in 1914, compared with 1909.

Replies to the list of questions of the Department were sent by 77 works which manufactured agricultural machinery in 1914, to an aggregate value of $168 120 632. In 1909 returns, the corresponding figures had been

54 works and $149 318 544, so that during the last five-year period the alue of the annual production increased $18 802 088, or 12.6 %.

The machines which mainly contributed to this increase are enumerated Table I.

TABLE I. — *Machines with maximum increase of production from* 1909.

Classes of Machines	Number of machines made		Percentage increase
	in 1909	in 1914	
eapers	136 022	215 386	58.3 %
pring-tooth harrows	114 341	118 247	64.6
rills	144 616	199 805	38.2
orn (maize) huskers and shredders	1 298	4 338	234.2
aize harvesting machines	19 819	52 087	162.8
ean harvesting machines	1 650	3 605	118.5
otton sowers	81 826	101 256	23.7
otato planters	23 142	37 276	61.4

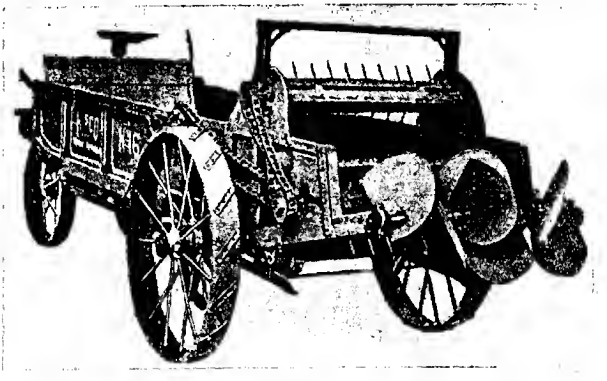
Table II gives a comparison, for 1909 and 1914, of the value of the production of the principal classes of machines and of the total production.

TABLE II. — *Compared value of the production of agricultural machines in* 1909 *and* 1914.

	Year 1909 (854 works)	Year 1914 (772 works)	Percentage increase (+) or reduction (—) (— 9 %)
Milling machines	$ 37 410 595	39 632 903	— 5.9
Planters and sowers	12 306 207	12 268 156	— 0.3
Harvesting implements	35 250 840	40 561 472	+ 15.1
Machines for separating grains and seeds (threshers, etc.)	11 588 986	13 986 184	— 20.7
Other machines and spare parts for machines of every description	46 619 354	60 211 327	+ 21.3
Repairs	3 142 562	1 460 560	— 53.5
Total value of production	$ 149 318 544	168 120 632	+ 12.6

1004 - **"Nisco" Manure Spreader.** — *The Implement and Machinery Review*, Vol. 42, N 494, p. 197, 1 fig. London, June 1st, 1916.

In this machine, built by the New Idea Spreader Company Ltd., Guelph, Canada, the caracteristic part is the spreading mechanism, whic lies behind the cart : it consists of a winged-rotating distributor (made steel), which, in revolving, spreads the manure over a width of about



« Nisco » Manure Spreader.

to 7 feet, and also crushes the lumps of manure which might have pass intact between the 2 spiked pulverising cylinders which feed the spread regularly and uniformly.

These 2 mechanisms are driven by 2 endless chains driven from t rear wheels of the cart.

The machine can be adjusted so as to spread 3 to 18 cart-loads manure per acre.

1005 - **Fore-carriage for Harvesting Machines.** — KNOBLOCH WILHELM, in *Deutsch. La wirtschaftliche Presse*, 43rd Year, No. 62, pp. 516-517, 2 fig. Berlin, August 2, 1916.

The fore-carriages constructed in agricultural machine worksh are generally complicated and consequently expensive. To provide ev the small farmer with the advantages of a good fore-carriage, the writ has designed a simple, practical and inexpensive arrangement of this kin which can be built by any village smith. Figures 1 and 2 show the fo carriage in a plan view and longitudinal section respectively.

The axle *a* is a simple square bar of iron (30 × 30 mm), carrying wh *b*, 1 metre apart ; the wheels of a scarifier may answer the purpose p fectly. In the middle of the axle a hole is bored in which a strong pivot *c* (from 20 to 25 mm in diameter) engages, fitted in the middle with a was 20 mm in height, and locked above by a flat key, and below by a nut.

To the axle there is rigidly connected the shaft *f*, which carries the ring-trees *g* and the cross-member *h*. Instead of the shaft fitted previously the harvester *l*, there is a U-shaped iron piece 2 m in length, the front part which is swanneck-shaped while the rear part carries a wood piece 65 cm length screwed to the U-iron. The curved front part of the iron U-piece ries a flat iron square *i* of 50 × 10 mm riveted to it, and pierced with a to 30 mm hole to take the pivot pin. Further, to the U-iron there is so screwed a solid iron rod *m* 1.3 metres in length, to prevent the rakes om fouling the guides when the vehicle turns.

Fore-carriage for Harvesting Machines, Knobloch type.

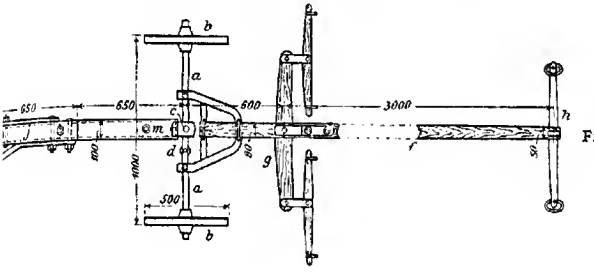


Fig. 1

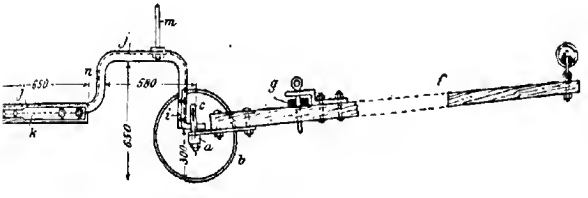


Fig. 2

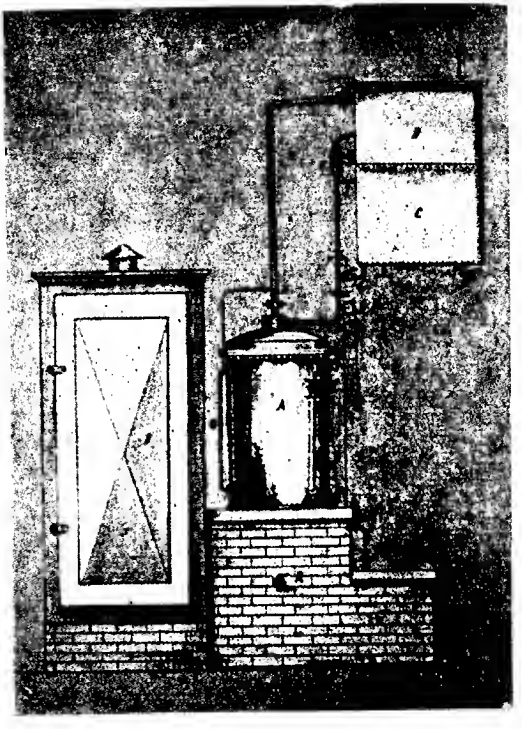
This fore-carriage may also be used for mowing machines. For this pose the axle has a second hole *d*, 10 cm from the centre, in which the ot pin *c* engages.

The shaft being, in the mowing machine, fixed from 10 to 15 cm higher, rear curve of the swanneck is made from 10 to 15 cm shorter.

With this fore-carriage, turns of 90° may be made both right and left, the machine may be backed if desired. The fore-carriage can never set, because the point of attachment *a* lies very low. The front axle is able to describe an angle of more than 45° horizontal relatively to the r axle.

1006 – **Apparatus for Extracting the Oil from Oily Substances by means of Non-inflammable Solvents.** — CIAPETTI GINO, in *L'Italia agricola*, 53rd year, No. 7, pp. 298-300, 1 fig. Piacenza, July 15, 1916.

The small open-fire apparatus represented on the appended figure admits the economical extraction of the oil of oily fruits and seeds and their residues (lees and cakes), even on the smallest farms, by means of solvents



Apparatus for extracting oil from oily substances by the aid of non-inflammable solvents.

which are non-inflammable and non-explosive, and also harmless and pleasant in smell, such as carbon tetrachloride and ethylene trichloride.

These two liquids, insoluble in water, dissolve fats in a larger proportion than benzine and carbon bisulphide, while possessing the advantage over the latter that they require less heat and less water for the process of evaporation and condensation. Although carbon tetrachloride is dearer than carbon bisulphide, it is nevertheless cheaper to use, owing to the fact

hat it undergoes far smaller losses during the process of extraction, which, n addition is carried much farther: while carbon bisulphide leaves up to 4.5 % of oil unextracted, with the use of the tetrachloride this loss does not exceed 1.6 %. Finally this solvent very readily gives up the oil extracted with which it does not form an emulsion as does carbon bisulphide) and, f the seeds or other oily substances to be treated are not deteriorated, an il as good as if extracted by pressure is obtained.

The essential part of the apparatus in question is an extractor *A* in which a metal gauze basket is suspended containing the oily matters to be subjected to extraction, broken up to allow of easy access to the solvent. The latter circulates from below upwards by means of the leaching-tube *O*, and thus effects the extraction of the oil in the form of a solution which gathers at the bottom of the extractor. The vapour of the solvent, rises through the pipe *H*, and is then conducted through the pipe *M* to *B*, where t condenses in a coil cooled with running water. By using the tap *P*, the condersed solvent may be made to return to the extractor, or through the pipe *I* it way be made to pass into the tank *C*.

When the extraction is completed, the extractor (placed on a furnace) s heated either with an open fire, or in a water bath in the case of delicate ils. In this way the bulk of the solvent is eliminated from the oil solution collected at the bottom, and afterwards, in order to remove the last traces, ot air is injected into the extractor by means of a small force pump. When this is done, the oil can be drained off by opening the tap R.

The waste heat of the furnace is used to heat the drier D, where the broken up oily material is kept for some time before extraction.

The apparatus being airtight the losses of solvent are very small.

To accelerate the work and make it continuous, the apparatus is made with 2 extractors, one of which is in operation while the other discharges and recharges for the next operation.

The appliance is easily managed, and does not require more than 2 workmen.

1007 - **Appliance for Burning Tree Stumps *in situ*.** — *Scientific American*, Vol. CXIV, No. 25, p. 643, 1 fig. New York, June 17, 1916.

This appliance, which is termed a "stump-burner", being a sort of portable stove for charring and destroying wood, was recently tried with success by a large forest working company in Mississipi (United States).

It is placed on a stump, and the latter subjected to slow combustion until completely charred, during which time the heavy oils (heavy products of dry distillation) are collected. When these operations have been completed on one stump, they are repeated on another, by carrying the apparatus to it, and so forth.

This contrivance is capable of rendering great service on cleared forest and to be brought under cultivation, as it greatly facilitates clearance, which the laborious rooting up of the stumps by ordinary means generally makes so expensive; it destroys the stumps to a sufficient depth to allow of ploughing without needing to cut roots or carry out any preparatory soil

work. At the same time this process is advantageous from the economic point of view (provided the stumps are thoroughly dry) as it yields products the value of which may entirely cover the costs of extirpation. Thus, an ordinary pine stump gave, in addition to excellent quality charcoal, about 15 gallons of heavy oils.

Battery of Tree-stump burners in operation.

1008 — Review of Patents.

Tillage.

Germany

286 313. Subsoil plough.
286 314. Gripper wheel for motor ploughs.
286 315. Horse hoe.
286 316. Return mechanism for cable-hauled ploughs.
286 317 — 287 810. Arrangement for ploughing, with 1 portable engine driving by cable 2 ploughs with return mechanism, between which it is set up.
286 318. Motor plough with rear supporting wheel, running on the unploughed land.
287 081. Furrow or ditch digger, especially for plantation.
287 082. Motor plough with driving gear for the steering wheels.
287 100. Regulating and clearing mechanism for plough wheels.
287 130. Rotary screw digger.
287 445. Ploughing machine with adjustable frame carrying plough share and coulters.
287 484. Drill with several rows of teeth.
287 573. Field harrow capable of use as a grassland leveller.
287 811. Method of fixing plough bodies.
288 015. Rigid frame hoe carrying the working parts and jointed to the shaft support.
288 569. Arrangement to prevent side displacements of the beam in wheel ploughs.
288 845. A sprung plough body.

288 846. Tillage machine driven by motor and impelled by the alternate action of shovels digging into the ground.
288 882. Method of fixing harrow teeth.
288 883. Drill acting as a borer in the soil (1).
289 482. Antibalance mechanism for tipping ploughs.
289 536. Carriage wheel for motor-driven ploughs and other tillage machines.
289 558. Portability device for wheel ploughs.

witzerland 73 030. Tilling machine.
nited Kingdom 3 517. Subsoil plough.
nited States 1 183 309 — 1 185 590. Plough regulators.
1 184 707. Horse hoe.
1 184 832. 2-row maize cultivator.
1 184 900. Double-breasted plough.
1 184 754 — 1 184 768 — 1 186 130. Harrows.
1 185 238. Device for raising and lowering harrows.
1 185 324. Subsoil plough.
1 185 325 — 1 185 504. Ploughs.
1 185 857. Plough disc.
1 185 923 — 1 186 515. Wheel ploughs.
1 186 355. Weeder.
1 186 365. Leveller for ploughed land.
1 186 441. Disc plough.

Draining and Irrigation.

nany 287 809. Device for drying peat beds, marshes, etc.
289 474. Automatic pond-emptying arrangement for irrigation.
289 821. Drains.

Manure Distribution.

many 288 324. Liquid manure barrel with distributor.
288 350. Appliance for dissolving nutritive salts in irrigation water.
289 973. Manure spreader.
ted States 1 185 133. Manure spreader.

Sowing and Planting.

many 286 694. Elevator for uniformly distributing bodies of different sizes particularly for potato planters.
287 336 — 289 887 — 289 921. Potato planters.
288 042. Drill for sowing at variable depths.
288 070. Drill with wheel for dibbling plants.

Cultivation.

ada 168 186. Glass-house.
many 287 063. Automatic arrangement for watering flower beds.
287 069. Glass-house window with wooden sash having grooves in which the glass panes may be inserted.
287 203. Nozzle for garden watering hose.
288 932. Arrangement for heating the ground by tubes placed therein.

(1) See *B.* February 1916, No. 217. (*Ed.*)

289 787. Detachable cement frame for hot beds.
289 788. Arrangement for lopping branches by means of a circular sa fitted at the end of a rod and driven by a pulley with cord
289 805. Arrangement for regulating the spead of rotation of waterin appliances.
289 954. Sash for beds with arrangement by which several at a time ma be opened or closed.

Spain 62 202. Vine sulphurator.
United Kingdom 3 968. Compressed air sprayer.
4 473. Sprayer.

Control of Pests.

France 480 015. Enclosure for catching rabbits, rats and other small animals.
Germany 287 772. Animal trap.
288 118. Method of destroying insect crop or house pests, and preservi clothing, furs, etc. from injury by them.
288 122. Fly trap with clockwork movement.
288 538. Wild animal trap.
289 330. Ditch arrangement for protecting crops against injurious anima particularly weevils.
289 462. Fly and gnat trap.
United Kingdom 4 025. Trap.

Harvesting Forage, Cereals, etc.

Germany 286 625. Harvesting machine with 2 cutting bars, one mowing flush wi the ground, the other located behind and above the fir
287 186. Scythe hammering machine.
288 832. Scythe hammering machine with revolving anvil.
288 884. Rake drum for binders, revolving as soon as a rake has g together a given number of straws.
289 786. Scythe and sickle hammering machine.
289 953. Locking device for the bolt screws used to fasten the teeth cutting bars on mowing machines.

Netherlands 1 407. Hay-maker.
United Kingdom 3 489. Machine for mowing rice, papyrus and other aquatic plants
United States 1 184 794. Maize harvester.
1 185 243. Mowing machine.
1 185 430 — 1 185 593. Horse-drawn hay rake.

Root and Tuber Crops.

France 478 964. Appliance for aligning beet and other machine harvested r crops.

Germany 286 275. Machine for lifting beets from 2 rows at once, with 2 adjustal mould boards fixed to a share.
287 337. Machine for lifting beets.
287 418. Machine for lifting potatoes, with loose chains adapting the selves to uneven ground.
287 446. Machine for topping beetroots on several rows at a time
287 710. Thrower wheel with forward driven forks for potato machine
288 253. Beet harvester with mechanism for throwing the beets
288 254. Sorting drum for potato lifting machine, consisting of 2 dru with different meshes engaging in each other

ited States 1 185 540. Potato, earthnut, etc. harvester.
1 185 785. Beetroot harvesting machine.

Threshing, cleaning and sorting Grains and Seeds.

any 287 131. Automatic thresher feed with arrangement for cutting the binder string.
287 537. Shaker for grain sorting.
288 479. Appliance for sorting coffee, dried leguminosae and other seeds.
289 458. Sorting cylinder with lining made of metal rings or spirally wound metal wire.
289 559. Fan for threshing machines.
61 942. Thresher.
n
ed States 1 185 957. Thresher.

Conveyance, handling and preservation of crops.

ala 158 058. Protective guard for fruit baskets.
158 091. Apple sorter.
168 152. Silo.
168 358. Exterior arrangement for holding together the planks forming a silo.
168 484. Guard device for banana bunches.
pany 287 083. Coupling for forage cutters.
287 101. Straw-press.
287 102. Straw-press for hand binding.
288 174. Potato, apple, etc., peeling machine.
288 351. Trellis-work support for strawberries and the like.
289 315. Chopping machine with sifting arrangement.
289 316. Arrangement for cleaning gooseberries and removing their stalks.
289 457. Mechanism for parallel direction of the feed cylinders of forage-cutters.
289 459. Forage cutters.
289 460. Press for cut forage, chop and the like
289 461. Chaff cutter with bent plate having convex cutting edge and plate for compressing the straw (1).
289 922. Straw press with oblique compression channel and needle entering from below.
)
erland 61 990. Straw and hay elevator.
77 909. Cart for hay and cereals.
ed States 1 185 155. Forage cutter.
1 185 457. Appliance for compressing grass in silos.
1 185 777. Straw cart.
1 185 845. Forage press.
1 186 302. Machine for chopping forage for ensilage.
1 186 505. Machine for making straw stacks.

Livestock Feeding.

nany 289 923. Multiple feed apparatus with food storage tank.
ted Kingdom 4 134. Trough.

Industries depending on vegetable products.

ugal 9 782. Appliance for improving wines with high alcoholic content.

(1) See *E.*, April 1916, No. 429. (*Ed.*)

Spain	62 035. New system of ferro-concrete receptacles for wines.
	62 166. Appliance for extracting vegetable oils, particularly from olive
United Kingdom	3 651. Bottle-washing machine.
	3 699. Method of extracting the albumen from the residues of vario vegetable oils.
	3 854. Method of filtration of cane juice.
	4 066 Bottle filling and capping machine.

Dairy Industry.

Canada	168 502. Churn.
Germany	288 352. Milk cooling and aerating machine.
	288 714. Centrifuge for milk and other fatty liquids.
	288 715. Centrifugal drum with false bottom for discharging skim mi
	289 442. Suction milking machine.
	289 537. Safety device for centrifugal machines for milk and other fa liquids.
	289 560. Churn with turbine-driven beater.
United Kingdom	3 782. Skimmer.

Steering and hauling agricultural machines.

Germany	287 067. Steering mchanism for agricultural machines with front whe mounted on pivoting axle arms.
	287 980. Tractor for tillage machines.
	288 255. Coupling a train of agricultural machines with a tractor
United States	1 168 340. Tractor.

Miscellaneous.

Germany	286 805. Calk keys for horse shoes.
	287 847. Wickerwork for fences.
	288 421 — 288 480. Arrangements for untying cattle in the byre.
	288 738. Incubator with arrangement for heating and moistening the introduced.
	289 055. Eel catcher.
	289 329. Horse-shoe with non-slipping fitting.
	289 757. Dog-training device.

FARM BUILDINGS.

1009 – **Automatic Watering of Dairy Cows** (1). — RINGELMANN MAX, in *Journal d'Agriculture pratique*, Vol. 29, No. 13, pp. 226-227, 4 fig. Paris, June 29, 1916.

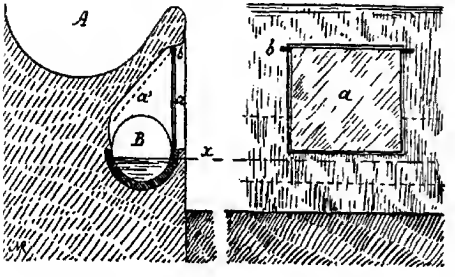
A simple and inexpensive system of watering cattle consists in providing beneath the manger *A* (fig. 1) a canal *B* in which the water is maintained at a constant level *x*. To the right of the place of each animal, a mouthpiece is fitted in the manger which can carry a shutter *a*, hinged on 2 pivots and which the cow pushes to *a'* in order to drink at *B*. The shutter measures 24 to 30 cm in width, and 20 to 25 cm in height.

Instead of using this patent system it is sufficient to place at every second stall a small trough *A* (fig. 2) made of cast iron, stone or cement in which a pipe *a*, connected to the main *b*, would ensure a standard level of water *x*. To avoid injury, the main *b* may be accommodated in a groove cut on the outer wall *y* of the crib *c*. The stone or cement trough may

(1) See *B.* 1914, No. 275. (*Ed.*)

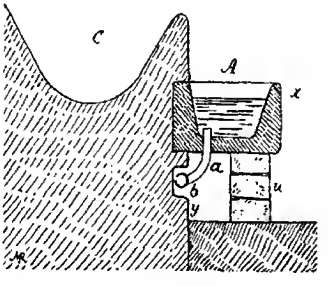
ported by a small wall *u*. The cast iron trough is fixed by lugs by means running bolts or wood screws, according as the wall to which it is attached nade of brickwork or wood.

Fig. 1.—*Watering arrangement beneath manger.*



Cross section Longitudinal view

Fig. 2.—*Watering arrangement in front of manger.*



Cross section.

RURAL ECONOMICS.

o- **Results of Farm Management Demonstration Work in U. S. A.** — GODDARD L. H., in *Proceedings of the Sixth Annual Meeting of the American Farm Management Association, Berkley Cal.* 9-10 August 1915, pp. 26-33. Washington, 1916.

The bill which authorised the establishment of the Bureau for Economic nprovement of Farms in the United States Department of Agriculture is passed on the 13th July 1914. The report of the 1st July 1915 shows at the work has been started in 21 States, and that during the period of ganisation in the first year, considerable work was done and noteworthy ogress achieved.

The work of demonstration was carried out in 105 different zones lyi in the 21 States in question in the territory of which the Bureau has to now been instituted, and comprises the economic study of 8 032 farm For 5 009 of them the compilation of analytic data serving to bring o clearly in the form of " Farm Analysis Records " the organisation and ec nomic results of the farm has been completed; 1 952 of these records we returned to the farmers concerned, after careful critical study on the pa of the officials who had prepared them (farm compilators). The discussi which took place in this connection concerning the organisation of the far and desirability of its modification resulted in 542 farmers approving and b ginning to carry out certain proposed changes, and 1 439 farmers adopting system of accounts which will in the future enable them to supply mo accurate particulars for the analysis record. Other farmers, to the numb of 876, applied for farm demonstrators to make a second visit to their farm in order to obtain advice in connection with reorganisation.

The considerable work accomplished since the outset *i. e.* during th period of organisation, is largely due to the co-operation of the Farm B reaus and County Agents in the different counties and the Superior Schoo of Agriculture. The chief object of the federal farm economics improv ment demonstration Bureau is to guide the county agents in this examin tion of the organisation of farms in their region, in order to come directly t the aid of the farmer who may have adopted an organisation which cannc yield him the normal reward far his labour, and who nevertheless maintain this system. They will point out to him the difference between the result of the organisation adopted by him and those normally obtained in the bel where he operates, and between such results and those secured by more skil ful and smart farmers who manage to get the largest possible reward fo their labour.

This Farm Economics Improvement Demonstration Bureau has beer successfully established in 21 States, and has above all rendered eviden the fact that in each region the economic results of the farms varies within wide limits. From the figures relating to 4 400 farms hitherto compile it is ascertained that the general average of the reward of labour of th farmer was about $ 400. If progressively organised farms are divided int 5 groups of 880 farms each, the 1st group, which represents the highest reward for the farmer's labour, has an average of about $ 1 500; the 2nd group about $ 700; the 3rd about $ 350; the 4th about $ 100 and for the 5th the loss is about $ 600.

Thus, $^1/_5$ of the farms not only yield no reward for the manual labour or management of the farmer, but in addition leave a deficit of $ 600 ea on an average on the return on the capital reckoned at 5 % and the rewa for the labour carried out by the members of the farmer's family.

The Farm Economics Improvement Demonstration Bureau is intend chiefly to come to the assistance of this last class of farmers, by pointi out to them the standard organisations in the zone where they operate, well as those of farmers securing the best reward for labour.

The appended Table shows by way of example the method of co

arison of the farm analysis records adopted in criticising the farms of west return.

In view of the importance of maize-growing in the region in question, m *B* shows that it has a unit production superior to the average of the gion, and an index of realisation of the products of livestock much higher an the average, and better than that of the most paying farms. The low ward to the farmer, below the average, is exclusively due to the insuf- ient area of the farm as compared with the unit of labour of the men and rses used. The owner of the farm *A*, who possessed a smaller farm than rented an area of land which enabled him to get rid of this disadvanta- ous factor, considering that the normal farm in the region covers about 0 acres. He thus secured a high reward for his labour, in spite of the low iciency of the conversion of feeds by his cattle. From a study of the va- ous organisations as compared with the standard organisation represented the average of a large number of farms (50 to 100) for each zone studied, actical indications are drawn for farm organisation considerably reducing e practical apprenticeship of farmers, and laying the rational bases for rm organisation in each agricultural region.

From the experience gained during the first period of organisation this important demonstration Bureau, the following conclusions are drawn:

1) In each region some farmers obtain results much in excess of e average from their farm.

2) These farms paying better than the others are not easy to di- inguish by mere external examination, on the basis of the more or less od condition, the more or less high quality of the livestock, or the total f the cash receipts.

3) The only reliable method for comparing the economic result ob- ined by a farmer with that of other farmers in a particular region consists l comparing the respective labour incomes (1).

4) For the majority of farmers who wish to improve the economic sults of their farms it is extremely useful to determine the labour reward the farmer, and if it is too low, to analyse the organisation of their farms its various component parts, and afterwards to compare the data thus lated with those of other farmers working under like conditions.

5) It is comparatively easy to make a brief analysis record of organisa- on, to calculate the farmer's labour income, and then to pass on to a itical comparison of these data on other farms, in order to determine the ecessary changes in such organisation.

6) Farmers generally are very favourable to this work of demonstra- ve research, provided the work is put to them in the proper way and at he right moment.

7) County agricultural agents and the teaching staff of schools

(1) The labour of the farmer is calculated by deducting from the gross proceeds the expenses capital interest at 5 %. The expenses include the labour performed by members of the ner's family, reckoned according to equivalent wages for hired labour. On the other hand farm products consumed by the farmer's family do not appear. (*Ed.*)

Comparison between Farms in the County of Iowa.

	Farm *A*	Average of 13 best farms	Average of 62 farms	Farm *B*
Farmer's labour income	$ 1 231	$ 1,050	$ 145	$ 72
Size of farm:				
Total area	282 acres	188 acres	171 acres	100 acr
Cultivated area	234	144	125	70
Livestock units	18	24	21	12
Total receipts	$ 3 393	$ 3 211	$ 2 430	$ 1 597
Quality of Business:				
Livestock: Returns on $100 of feeds consumed	$ 102	$ 130	$ 119	$ 164
Crop yields:				
Maize . . . bushels per acre	50	43	38	40
Oats . . . " " "	37	40	37	37
Hay . . . tons	1.3	1.6	1.6	1
Efficiency of labour:				
Crop acres per man	102	85	75	59
Crop acres per horse	37	22	18	12
Diversity of business:				
Principal receipts:				
Maize	$ 680	$ 813	$ 615	$ 360
Oats	584	304	240	—
Pig breeding	843	868	685	680
Cattle breeding	556	536	359	355

of agriculture well trained by a farm management demonstrator speedily become capable of rapidly ascertaining the reward of the farmer's labour and making the comparative examination of organisation of different farms This special competency of the persons who are at the heads of local agricultural interests in this branch of rural economics forms the first direct object towards which the organisation of this Federal Bureau tends.

8) Many farmers easily succeed in computing themselves the reward of their labour, and analysing their farm, under the guidance of the local farm Bureau, and this is the final object aimed at by the central Government in establishing this Institution.

9) The Farm Economics Improvement Bureau is furthermore highly useful to the county agricultural agents and these whose duty it is to watch over local interests, as it affords them the means to getting a better knowledge of the real agricultural conditions of their region, and the problem

hich farmers are called upon to meet, by bringing them into touch with e farmers in a form very promising as regards agricultural progress.

11- **Crop Yields and Prices and Future Food Supply in the United States.** — WARREN G. F., in *Cornell University, Agricultural Experiment Station of the College of Agriculture. Department of Farm Management*, Bulletin 341, pp. 185-212. Ithaca, N. Y., February 1914.

From an examination of the unit production of the principal agricultural roducts in the United States from 1879 to 1912 and their prices from 840 to 1912, the writer derives the following conclusions, which present eneral interest from the point of view of the future direction to be taken y production.

The gross prices of agricultural produce from 1905 to 1912 are found o be slightly above those of the average for the last 73 years, as shown by he following table :

			Average for 73 years	Average 1905-1912
Maize	(New York)	per bushel	$ 0.65	$ 0.66
Winter wheat	(New York)	per bushel	1.25	1.04
Cotton	(New York)	per pound	0.154	0.118
Potatoes		per bushel	0.65	0.62
Oats	(New York)	per bushel	0.45	0.47
Pigs		per bushel	5.71	6.78
Cattle		per bushel	5.74	6.37
Sheep		per bushel	4.00	4.20
Butter		per pound	0.244	0.262
Eggs		per dozen.	0.226	0.287

The prices obtained by farmers for animal products are seen to be ove the average, but those of crops are nearly equal to or below the average r the last 73 years. During an entire generation, in the period of settlement of the great prairies in the West of the United States, the prices were ry low, so that in comparison with this period the present prices are no ubt high, but very little exceed the general average for the long period in estion. During the last 10-15 years the unit production in East Mississippi has increased rapidly, while before that, especially towards 1890 there as a period of low yields and abandonment of the countryside by young en, due to the excessively low price of products.

Farmers, generally speaking always succeed in increasing the nit production as soon as the prices of products are barely sufficient o justify the increased expense required to obtain an increase in production. In each county of the United States there are still considerable areas f land which might be brought under cultivation by clearance, drainage, rigation, etc., but the extensions enabling the production to be increased ithout increasing the cost prices are henceforward very limited. The nds to be cleared, drained, irrigated or heavily manured are expensive lands nd their products will consequently be dear. When once an average unit roduction is attained, every bushel of production obtainable above this verage generally costs more than the previous one. The limit of produc-

tion per unit of surface in the United States is far from being attained, but the phase of production at cheap cost price has been passed.

The farmers rapidly adapt their production to the price of products and if the present prices are maintained the production will increase, and if they go up still further the production may grow considerably.

There is apparently no likelihood of the prices paid to farmers for their products showing a permanent decline. There are some means, however, by which the price of products to the consumers may be reduced. The present mechanism of the distribution of agricultural products to consumers is exceedingly expensive in the United States, and a great part of the expenses entailed might be eliminated. A sum ranging from 50 to 66 % of the price paid by the consumer does not reach the producer, and the greater portion of this percentage is absorbed by the town distributing mechanism. It is estimated that one-half of these expenses could be eliminated; such a saving in distribution would of course entail a change of occupation of a large part of the persons occupied in the present system.

Necessarily, in proportion as the population increases, the consumption of the less expensive commodities also increases, and beef is one of the most expensive agricultural products, because in order to obtain it a considerable quantity of cultivation products must be converted. It has been calculated that a given quantity of cereals can feed a number of persons five times greater than the meat obtainable by transformation of these cereals. With the increase of population, the price of cereals goes up more rapidly than that of meat. A given quantity of products converted into milk produces a larger quantity of commodities intended for human consumption than would the same quantities converted into meat; consequently the number of dairy cows increases almost parallel with the growth of the population. The United States possess one cow to five head of inhabitants. In addition to the milk, this quantity of dairy cattle yearly supplies a calf, a cow and a bull to the butcher for each family.

Pigs convert the food intended for animal consumption more economically than beef cattle, and with the same quantity of cereals a higher proportion of meat is obtained with pigs than with cattle. This explains the increase in the number of pigs and the reduction in the number of beef cattle. Poultry, finally, convert foods still more economically than other classes of domestic animals. The substitution of eggs for beef is observed chiefly in those parts where the greatest increases of population occur. From 1890 to 1910 the increase of the population in the 7 principal egg-consuming markets (New York, Chicago, Boston, Saint Louis, Cincinnatti, San Francisco and Milwaukee) was 78 % and the increased egg consumption amounted to 183 %. When the population becomes very dense, the forage produced on farms is converted into milk, and the meat production is limited to the quantity obtainable from the forage and grasslands still available when the former demand has been met. The quantity of cereals transformed by means of cattle diminishes constantly. This state of things finds its confirmation in the progressive reduction of fattening cattle and in the tendency to kill off young animals for the butcher.

All these modifications in the direction of production prove that the antity of meat available per inhabitant is diminishing, and that unfor- nately the classes who must renounce a large meat consumption are those ıgaged in manual labour, that is, the very classes who most feel the need r meat food. All this finally proves that the United States are also perienciug the first symptoms of the state of things always observeable densely populated countries. Though it is likely that in the future ıe United States will be able to feed the numerous population which is to anticipated, it is certain on the other hand that the future population ill not be able to live so well as does the present.

The writer sees in the localisation of manufacturing industry in rural istricts the possibility of considerably reducing the cost of living, while llowing the workman's family to have a garden or even a small farm which an furnish vegetables and poultry, together with a sufficient quantity of orage to keep a dairy cow. He nevertheless criticises the opinion maintain- d by many persons that in order to reduce the cost of agricultural products would be necessary to break up farms and reduce their size, because no- ing but disadvantage to consumers can result from the fact that a reater portion of the products is consumed by a larger number of produ- rs and labour animals employed per unit of area.

In the general farming region, from the State of New York to Nebra- ka, the tendency in reality is to pass from a farm with two pairs of horses .e. from 80 to 100 acres to one with three pairs, *i.e.* from 120 to 150 acres, wing to the fact that by working smaller areas the horses which are indis- ensable to haul modern labour-saving machinery are not completely uti- sed, and consume an excessive proportion of the gross product.

Farms specialising in market-gardening and fruit production may be naller, but to meet the demand for these products a very small number of rms is required as compared with those needed to meet the demand for reals, forage, potatoes, livestock and derived products; for this class of pro- uction the medium sized farm, as will be seen, supplies the consumer with quantity of products per unit of surface greater than that furnished by e farm of smaller area. China, the classical country of the very small rmer, really exhibits a picture of an agricultural population which, in te of the assiduous labour of men, women and children, scarcely succeeds producing a little more than what it consumes to live, and which is only le to maintain a small percentage of consumers in towns. The low price labour is the index to the poverty of this population. As long as the high ice of labour continues in the United States, so long will the use of ma- inery and farm horses be required for growing the principal agricultural oducts, and this will entail such size of farm as may be adapted to the st utilisation of such machines and horses.

The Author strongly recommends the restriction of immigration by creased severity in the regulations for the admission of emigrants, as rming one of the best means to prevent the cost of living continuing to se more and more, and putting a stop to the present tendency to lower e standard of living now obtaining.

Furthermore, considering the extraordinary needs for phosphorus for vast tracts of land in the United States, the writer thinks that the time has arrived to make a careful estimate of the stores of phosphates in the United States, and if need be, to restrict their export.

1012 - **Time and Method of Tillage on the Yield and Comparative Cost of Production of Wheat in the Pelouse Region of Eastern Washington.** — THORN C. C. and HOLTZ H. F., in *State College of Washington Agricultural Experiment Station, Bulletin* No. 123, Pullman, Wash., July 1915.

The data summed up in the appended Table result from a series of comparative tests of cultural systems with biennial rotation and systems of tillage of the soil, for wheat growing in the region of Pelouse, in the east of the State of Washington, U. S. A. These trials were carried out in such a way as to eliminate as far as possible the influence of factors other than those inherent in the different methods of soil tillage, both as regards the time and mode of carrying them out.

System of cultivation	Yield in bushels per acre		Gross returns per acre	Cost per acre	Net returns per acre
I. Maize and wheat alternating, with annual autumn ploughing	maize	30.0	$ 56.24	$ 13.65	$ 42.59
	wheat	37.8			
II. Alternate peas and wheat, with annual autumn ploughing	peas	32.0	52.56	17.35	35.21
	wheat	33.7			
III. Wheat and summer fallow, with autumn ploughing after wheat	wheat	49.4	39.50	10.05	29.45
IV. Wheat and summer fallow, early spring ploughing (April 3) and rolling	wheat	49.0	39.20	10.55	28.65
V. Summer wheat and fallow; early spring ploughing (April 3) without rolling	wheat	51.7	41.36	10.35	31.01
VI. Summer wheat and pasturage, with autumn ploughing after pasturage	wheat	20.2	17.16	6.15	11.01
VII. Summer wheat and fallow, with late spring ploughing (June 10) and rolling	wheat	38.5	31.00	8.80	22.20
VIII. Summer wheat and fallow; late spring ploughing (June 10) without rolling	wheat	36.6	29.28	8.05	21.2
IX. Summer wheat and fallow; early spring disking (April 3), late spring ploughing (June 10), rolling	wheat	42.4	33.92	9.70	24.2
X. Summer wheat and fallow; autumn harrowing, late spring ploughing (June 10), rolling	wheat	37.3	29.84	9.20	20.6
XI. Summer wheat and fallow; autumn ploughing, late spring harrowing (June 10)	wheat	49.7	39.76	9.45	30.31

The analytic calculation of the expenses was made according to the following actual unit costs (per acre):

Ploughing	$ 1.50	Binding and shocking wheat	$ 1.35
Disking	0.50	Cultivating maize	0.50
Harrowing	0.20	Maize harvesting	2.00
Rolling	0.50	Pea harvesting	2.00
Sowing	0.40	Threshing	0.10 per bushel

The cost of cultivation calculated in this way is only aimed at bringing out clearly the relative value of the different systems in reference to the biennial rotation used, and making a fresh contribution to working economics as regards the wheat growing in the region where the comparative trials were conducted.

013 - **Enquiry into the most usual Depreciation Rates for Agricultural Machinery in Minnesota, United States.** — *Farm Implement News*, Vol. XXXVII, No. 22, p. 18. Chicago, June 1, 1916.

The Farm Economics Bureau of the Minnesota College of Agriculture has published the results of the enquiries carried out on 24 farms in the State of Minnesota, for determination of the rate of depreciation of the principal agricultural machines.

The figures of Table I represent the average for the 24 farms studied, and the observations are based on the use of the machines in question during 10 years.

TABLE I.

Name of Machines	Annual rate of depreciation
Grain binders	6.54 %
Grain drills and seeders	5.06
Maize binders	7.97
Maize planters	6.41
Maize cultivators	6.23
Mowers	6.80
Hay tedders	4.21
Hay loaders	7.37
Rakes	6.30
Gang ploughs	6.41
Sulky ploughs	8.34
Walking ploughs	5.85
Waggons	3.89
Harrows	5.88
Discs	5.29
Manure spreaders	10.37
Hay elevators	8.54
Reapers	9.27
Silage cutters	7.43
Cream separators	7.93
Fanning mills	3.74

These rates of depreciation are based on an extensive use of the machines, as is apparent from the low unit rate per acre obtained on taking into account the area annually tilled (see Table II).

TABLE II.

Machinery	Average value consumed annually per acre
For cereals:	
Binders	$ 0.168
Drills	.072
Fanning mills	.014
Waggons, sleds and racks	.077
For maize:	
Reapers and binders	.604
Cultivators	.223
Planters	.083
Silage cutters	1.216
Waggons, etc.	.165
For hay:	
Mowers	.167
Rakes	.079
Forks, slings etc.	.046
Loaders	.005
Tedders	.062
Waggons, etc.	.155
For cultivation generally:	
Ploughs	.095
Harrows	.016
Disc pulverisers	.037
Manure spreaders	.337

1014 – **Profit ensured in Southern Rhodesia by Treating Potatoes with Bordeaux Mixture.** — JACK RUPERT W., in *The Rhodesia Agricultural Journal*, Vol. XIII, No. 3 pp. 354-360, Pl. I-II. Salisbury, Rhodesia, June 1916.

The writer proposed to ascertain whether, from the financial point of view, there was any advantage in treating potatoes with Bordeaux mixture for control of the disease known as "early blight" caused by *Alternaria Solani*.

The experiments, which were continued for three years, dealt with the "Up-to-date" variety, the chief one grown in the region under examination, and also one of the most resistant to the disease. In the experiments every second row of potatoes was treated and the intermediate row left for control of the results. In this way, the errors due to the differences of fertility in the other plots and those produced by irregularity in the spread of the disease were avoided. Furthermore, the rows treated were nevertheless exposed to infection from the untreated neighbouring rows, while in the latter, the risks of infection by the passage of spores from one plant to another were reduced by the presence of treated rows.

In short, the conditions were such that they tended to reduce the differences of yield due to the treatment between the treated and the untreated ones.

TABLE I. — *Increase of yield due to spraying.*

Number of days between successive sprayings	Number of sprayings	Total yield			Table potatoes			Seed potatoes			Marketable potatoes
		Treated	Untreated	Percentage of increase	Treated	Untreated	Percentage of increase	Treated	Untreated	Percentage of increase	percentage of increase
		lbs.	lbs.		lbs.	lbs.		lbs.	lbs.		
7	7	104	77	53	38	16	137	41	26	57	88
14	4	87	59	30	15	10	50	41	28	46	47
21	3	87	77	16	19	15	26	48	42	14	17

TABLE II. — *Estimate of profit due to spraying.*

Number ays between sprayings	Number of sprayings	Marketable tubers increase per acre lbs.	Value, at ¾ d. per lb.	Cost of spraying at 10/— per acre	Net profit per acre from spraying
			£ s. d.	£ s. d.	£ s. d.
7	7	3 772	11.15.0	3.10.0	8. 5.0
14	4	1 836	5.15.0	2. 0.0	3.15.0
21	3	1 020	5. 4.0	1.10.0	1.14.0

In spite of this the differences were considerable, as will be seen from e appended tables, the first of which gives the increase of yield due to the atment, and the second the profit secured by the operation. The treatnt was carried out with a Bordeaux mixture consisting of 4 lbs of copper lphate and 4 lbs of fresh lime per 40 gallons of water. The rows were 2 t 6 inches apart, and the plants 15 inches apart in the rows.

AGRICULTURAL INDUSTRIES.

15 - **Conditions under which the Cold Storage Industry will Render the greatest Services to the Vine-Growing Industry in Tunisia.** — RAY GEORGES, in *Le Froid*, 4th Year, Vol. IV, No. 1, pp. 19-34, diagrams 5. Paris, January-June 1916. INDUSTRIES DEPENDING ON PLANT PRODUCTS

The writer points to the special interest presented by the application cooling methods in wine growing in Tunis, where, owing to very high

temperatures, the alcoholic fermentation of the musts may be either dis astrously shortened or dangerously prolonged as the case may be.

The Question of Musts. — In normal years, the methods of control usually employed in Tunisian wine cellars to obviate an excessive rise of temperature in the vats give satisfactory results, if care is taken to work on normal musts properly corrected with regard to the due proportions of their elements, especially in respect to acidity and saccharine content. The usual means of prevention consist in :

1) Cooling the grapes as a prior precaution during the night, leaving them outside in pans or boxes, after sometimes sprinkling them with water ; 2) using small vats, in which the losses of heat by radiation are proportionally larger than in the large ones ; 3) raising of the must, with or without aeration ; 4) drawing off must, that is to say racking, as soon as the temperature in the vats reaches the dangerous point (35-37°C) ; 5) using metallic vats in order to increase the loss of heat by radiation ; 6) using cooling agents ; unfortunately the water for feeding these cooling agents is insufficient and lukewarm ; 7) using antiseptics, the mutage being effected with sulphyrous anhydride, on condition that not more than 450 mmg. of sulphurous acid per litre (of which 100 mmg. in the free state) remains in the wine ; 8) using local yeasts acclimatised to sulphurous anhydride ; 9) utilising several of the above mentioned methods of prevention together.

In hot years, as for instance 1913, these methods are often impotent to moderate the irregular course of fermentation. The following two examples are given : 1) the first relates to a highly concentrated must, as it showed an initial density of 1093 (or 218 grms. of sugar per litre). The first slight sulphuring is carried out (7.5 grms. of sulphurous acid per hectolitre) and fermentation starts pretty rapidly, being activated by the raising of the must ("remontage"). As early as the third day, dangerous temperatures are reached, and on the fourth the temperature is 37° C. The cooling is then done in a refrigerator, which brings it down to 34° C. and then, after another rise, the must is racked off at 33.5° C. 7 days were required to effect attenuation which was quite inadequate because racking is effected at 1013 (instead of 0.995-0.997 which a normal fermentation of 4 days should produce) 2) The second example, on the contrary, presents the case of a highly accelerated fermentation. After sulphuring with 15 grms. of sulphurous acid per hectolitre, the temperature reaches 35° C. in 12 hours. The first refrigeration details a gain of two degrees only, then the temperature goes up again to 35° and a second refrigeration is effected. Racking is carried out after barely 4 days of fermentation, with an almost normal reduction.

Possible Solutions. — It results from these facts that the means customarily used to prevent abnormal rises of temperature in the fermenting vat are powerless in hot years to ensure satisfactory cooling. Consequently the possible solutions are considered, and are brought under two general methods : *A*) wine making is conducted during the hot season, the effect of cooling being increased by resort to artificial cold; *B*) or the principal fermentation should be left over for a temperate period (autumn or winter

ıting the must by a suitable process, which forms the very essence of ne making.

A. — In order to increase the effect of refrigeration, either ice must used for storing cold, or the necessary cold must be produced on the spot means of a freezing machine. In either case, refrigeration may be effect- in the vats direct, or outside, the usual refrigerating agents being retained.

(*a*) For refrigeration in the vats, the addition of ice to the must, which is ıatering prohibited by law, is not to be thought of. On the other hand ice ıts might be employed, as in breweries. The cooling effect, however, is her limited owing to the small bulk of the floats, and it is fairly difficult put the latter in owing to the cap formed by the grape skins. To over- ne this diffienlty the method proposed by commandant SIGAUT is sug- ıted, which consists in adding to the must to be cooled blocks of must zen in ice-making machines. There remain the stationary or detachable ices for control of temperature. The fixed ones, which form an expensive l troublesome method cannot be recommended; the detachable s, similar to the "flags" utilised in breweries, might render very great vice on condition that they are designed in such a way that they can be ily immersed in the small depth of liquid lying above the crust.

(*b*) The system of cooling outside the vats presents the advantage t the already existing refrigerators can be used, it being sufficient to rease their effect by feeding them with frozen water or even with freezing brine. The carriage of the ice however in Tunis presents ıe difficulty, so that it seems desirable to resort to the installation of mall freezing machine in each cellar.

(*c*) There remains the idea, again modelled on breweries, of cooling whole room in which fermentation takes place, in the hope of securing, low fermentation, an apparently more rational utilisation of the yeast smaller losses by evaporation (alcohol and bouquet). The writer, r recording the failure of the attempts made in this direction, considers process as unrealisable both from the practical and economical point iew.

B. — Finally the industrialisation of the wine industry, to be carried in big factories working throughout the year, appears to be the most sfactory solution as regards the future of the problem of the wine manu- ure in hot countries. It is suggested that the preservation of the must hout antiseptics (or after slight sulphuring) might be ensured by keeping old storage depots where it would wait for the favourable period for fer- itation, after which it would be brought back to the cellar.

Immediate Solutions. — Until such time as the industrial methods of weries are adopted (the really rational solution of the problem), the Au- r suggests immediate solutions of the problem by which, without heavy , the recurrence of difficult seasons such as that of 1913 might be avoided. The idea of effecting a low fermentation in wine manufacture must be nissed completely. North African yeasts are excellent yeasts, and it ot expedient to make them work at temperatures below 28-30°C. On other hand, an increase of temperature in the vats must be prevented

in order not to exceed the fatal figure of 33°C, which may be done by the u of ice or by installing a freezing machine, either system being employe for suitably cooling the water circulation intended for feeding the ordinar refrigerators. The expense of purchase and installation of a small coolin machine is relatively small, and the plant might be utilised for various pu poses, the most interesting of which would be the concentration of must with a view to obtaining "mistelles". The clarification of young wine by cold, and that of liqueur wines, and the preservation of musts in orde to produce "non-alcoholic wines" are also points likely to attract attentio

1016 – **Methods of Detecting the Admixture of Cider to Wine.** — DELLE E., in *Le Moniteur Vinicole*, 61st Year, No. 28, Paris, July 11, 1916.

A fraud is perpetrated whenever a mixture of wine and cider is sol under the name of wine, and it is essential, when the case arises, to detec this fraud by carrying out the analytic and organoleptic investigations b which it may be determined.

According to the writer, one of the safest reactions is the special smel given off by the extract when calcined to ash; it is easy to recognise th odour peculiar to cooked apples or pears. In order, however, to distinguis this odour quite clearly, the liquid must be gently heated over a burner o a spirit lamp, and the vessel removed from time to time from the source o heat, because if it were maintained in the hot part of the flame irritatin smoke would be produced, which would affect the sense of smell and disguis the particular odour sought for. The proportion of alcohol in the extrac and the percentage of malic acid should be used to confirm the impressio gained in this way.

Furthermore, when cider is distilled, the alcohol has a peculiar smell due partly, but not wholly, to the acetic ether. Its smell is easily detected even in a mixture, by the practised sense.

In conclusion the different chemical methods utilised for determinin the percentage of malic acid are enumerated.

1017 – **Preparation of Germ-free Maize Flour; Investigations in Hungary.** – WEISER ETIENNE, in *Vegyészeti Lapok* (Journal of Chemistry), Year XI, No. 11, pp. [illegible] Budapest, June 10, 1916.

It is well known that flour, semolina and maize bran prepared on th method of grinding generally adopted in Hungary, comparatively soon deteriorate. Their deterioration, which is indicated by a more or less rancid odour, is occasioned by the decomposition of their fatty matter. The bulk of the latter being furnished by the germs, the products could keep for a greater length of time if the germs were removed at the time of their pre paration.

HABERLAND and LEG found in 6 samples of maize, from 10.62 to 12.23 % of germs, that is on the average 11.68 lbs of germs per 100 lbs of maize. These results agree with the figures of BALLAND, according to which 100 lbs of maize would yield 12.4 lbs of offals, 74.1 lbs of floury grain and 13.5 lbs of germs. According to BALLAND, the chemical composition of these 3 components is as shown in Table I.

ABLE I. — *Chemical Composition of the 3 components of the Maize Grain.*

	Husk	Flour	Germs
Water	9.80 %	12.10 %	7.20 %
Crude protein	7.40	7.50	14.22
Crude fat	2.10	0.95	36.98
Crude fibre	10.15	0.35	1.85
Ash	1.30	0.60	7.30
Nitrogen-free extract	69.25	78.50	32.45

According to these figures, the maize germ contains as much fat as the ds richest in fat cultivated in Hungary.

The grinding of the maize grain with germs removed has long been ctised in America, and also in Hungary, where, at the "Hungaria" mill idapest) the germ separated from the flour and the semolina is added to bran. Thanks to this process the flour and semolina are capable of ng kept for a long time ; on the other hand, the bran mixed in this way h the germ keeps for a very short time only. In addition, this operation cludes any utilisation of the oil contained in the germ.

Mr. JEAN MELEGA, a miller at Orosháza (comitat of Békés), has advised ethod of germ removal from grain and extraction of the oil of the removed ms which has attracted the attention of Hungarian millers. This opera- being very simple, each mill will be able to prepare flour, semolina bran germ-freed, and to produce maize oil. The method is as follows :

The maize grains, freed beforehaud from impurities, are several times sed through a number of fluted rollers, the flutings in the lower ones being er than in the upper. The ground grains fall on a bolting machine, which ws the flour and semolina to pass through but retains the germ. The m is ground and then bolted ; this process is repeated until the bran is irely removed from the germ. The oil is then expressed from the lat- and the oil cake is left behind as a food for livestock.

The writer has analysed all the products of maize grinding taken from mill of Orosháza, and has obtained the results set out in Table II.

ABLE II. *Chemical Composition of the Products of Maize-grinding.*

	Water	Crude protein	Pure protein	Crude fat	Crude Cellulose	N. free extract	Ash
ole grains	16.9 %	9.0 %	8.7 %	4.0 %	1.7 %	67.3 %	1.1 %
ur from grain with their germs	16.9	8.8	8.6	3.9	1.2	67.9	1.3
ur from grain with germs removed	18.2	7.2	7.0	1.6	0.7	71.7	0.6
olina with germs removed	13.9	9.0	8.1	1.4	1.0	73.7	1.0
n with germs removed	12.6	9.6	9.0	6.5	10.6	58.6	2.1
m cake	8.7	16.8	15.2	10.6	4.7	53.5	5.7
m before oil is expressed	16.2	14.3	13.0	17.6	3.3	43.7	4.9

The MELEGA process therefore furnished fairly good results: there is substantial difference in the percentage of fat between the flour of wh grains and that of grains with their germs removed, which would seem show that the latter flour can be kept longer than that of maize prepar on the method generally adopted hitherto in Hungary. The percentage fat in the bran is not very much diminished as compared with the corre ponding percentage in the bran produced on the old method, which prov that the sample examined still contained a fair amount of germ. Accordi to the analysis of the writer, the content of fat in several other samples maize bran fluctuated between 7 and 14 %. The content of fat in t germ cake is relatively rather high, which must be attributed on the o hand to the fact that the sample taken had not been sufficiently presse and on the other that it still contained a fair amount of bran (the latt retaining a good deal of oil). Therefore the more successfully the hu parts are removed from the germs the more oil will be extracted.

The writer also made a series of investigations into the oil yield, a found that 100 lbs of maize contained 4 lbs of oil. The quantity of the di ferent products of grinding and their percentage of oil was as shown Table III.

TABLE III. — *Oil Yield of the Maize Grain and its various Grinding Product*

70 lbs of	flour and semolina	with	1.6 %	of oil yielded	1.12 lbs of oil
13 „ „	germ flour	„	17.6 %	„ „	2.20 „ „
8 „ „	bran	„	6.5 %	„ „	0.52 „ „
5 „ „	flour	„	1.4 %	„ „	0.07 „ „
4 „ „	loss				
100 lbs of	maize yielded				4.00 lbs of oil

The oil expressed from the germs is transparent and reddish-brown colour. For its chemical composition the writer found practically the sa figures as other workers. When refined, maize oil is edible; it may also l used for manufacturing margarine and similar fats, coloured soaps, etc.

Several enquiries have been addressed to the Hungarian Station Biology and Animal Feeding in Budapest as to whether the extraction of t fat from the maize grains will not unfavourably affect the fattening of pig No doubt the nutritive value of maize rich in fat is greater than that maize poor in that substance, because among nutritive substances fat co tains the highest value of chemical energy. The writer ascertained th the extraction of the fat reduced the gross value of the chemical energy maize by 6.25 %. On the other hand, as compared with this relative small loss, the extraction of the fat from maize entails the following advan ages:

The semolina of maize poor in fat keeps better than that from whi the germs have not been removed.

With the extraction of the fat there is a slow increase in the quanti of protein, which is of advantage from the point of view of feeding you pigs.

It is well known that maize oil softens the fat of the pig and thus im-
rs its quality. On the other hand the fat produced by feeding with
ize poor in fatty substance is firmer, and thus possesses more value than
t mentioned.

8 - **A Cheap Process for Extracting the Oil from Oil fruits and Seeds and their Residues (black Olives and Oilcakes) by means of non-inflammable Solvents.** — See No. 1006 of this Bulletin.

9 - **The Conversion of Fruits and Vegetables into Dried Products: Experiments at the Royal School of Horticulture and Pomology of Florence, Italy.** — VALVASSORI V., in *Atti della Reale Accademia economico-agraria dei Georgofili di Firenze*, 5th Series, Vol. XIII, Part 2, pp. 56-64, 1 fig. Florence, April 1916.

For the preparation of dried *pears* and *apples* the best results have
en obtained on the following method. The fruits, having been peeled
l cut in halves, are subjected to the action of sulphurous anhydride in
hest fitted with gratings, are then scalded in a steam stove and dried in a
DER drier at a temperature of 80° to 90°C. The length of time found best
the treatment with sulphurous anhydride and with steam, and in drying,
re the following respectively :

	Sulphurous anhydride	Steam	Drying
For the "Coscia" pear	15 minutes	10 minutes	8 hours
" " "Gentil bianco"	10 "	5 "	8 "
" " "William"	15 "	5 "	8 "

The "Tondona President", a non-clingstone peach, peeled, cut into
ves, with its stone taken out, sulphured for 15 minutes and kept in a
er at the above temperature for 7 to 8 hours, yielded a fine product. A
ilar method was adopted with apricots.

In the experiments made with plums, the varieties "Friulana",
laudia mostruosa" and "Porcina" were used. The first appeared very
l adapted for drying, the second less so, and the last not at all. The
'riulane" plums were subjected partly to the treatment with steam for
and a half minutes, partly to scalding in a boiling solution of 5 %
ength potassium carbonate, and afterwards plunged into running water.
h the first and the second were then placed in the drier for 3 days, at
t in a closed drier at 50°C., and then at 60-70°C., finally in an open drier
80-90°C. Both groups came out successfully. The fruits did not crack.
se which had been treated with steam dried more quickly than the
ers.

"Turca" and "Pistoiese" cherries treated with steam for 5 minutes,
n kept in a drier at 80-85°C, dried in about 12 hours and yielded a fine
duct. Those which had not been treated with steam afterwards re-
red a longer time for drying.

The figs of the "Dottato" variety, peeled or cut open in halves, or
ole, treated with sulphurous anhydride for 30 minutes and kept in a drier
40-50°C. for 2 or 3 days, gave a good result in all cases.

Length of time during which Vegetables must be scalded or treated with steam; temperature; length of drying and yield of the vegetables mixed to form a "Julienne".

Kitchen Garden Products	Time during which products must be scalded (Sc) or steamed (St)	Drying temperature	Time required for drying	Yield per 100 lbs. of the fresh vegetables	Special solutions for scalding
Potatoes	Sc 3 to 5 minutes	50–60° C	10 hours	30 lbs.	Steep in water with 0.5 % solution of bisulphite of soda; also for potatoes only, scald in salt water of 2.5 % strength
Carrots	Sc 2 1/2	60–65	10	11	
Kohl-rabi	Sc 3 to 4	50–60	8	10	
Headed cabbage	St 2 to 3	50–60	7	7	
Green cabbage	St 2 to 3	50–60	7	7	
Cauliflower or sprouts	Sc 5	60	9	4–5	Scald in 3 % salt water.
Spinach	St 1/2	30–40	6	6	
Celery leaves	—	40–50	6	20	
Kohl-rabi leaves	Sc 2 to 3	40–50	6	8	
Peas	Sc 4	40–50	7	6–7	Scald in water with 2 ‰ bicarbonate of soda.
French beans	Sc 1	50–60	8	8	
Onions	—	40–50	10	15	
Leeks	—	40–50	8	11	
Turnip roots	Sc 2 to 3	50–60	8	10	Scald in 3 % salt water.
Celery	—	40–50	9	6	
Parsley leaves		40–50	9	18–20	
Turnip leaves	St 1 to 2	40–50	6	8	

In the appended Table there are summarised the experimental results tained by the writer in connection with the drying of mixed vegetables form a " Julienne ". A mixture in the following proportions is advised, opted by the School of Pomology of Florence (of which the writer is the ector) and a big factory at Gorizia: Potatoes, 30 %; carrots, 25 %; kohl-i (roots), 3 %; celery (sticks), 4 %; headed cabbage, 6 %; green cabbage, %; cauliflower, 5 %; spinach, 1 %; celery leaves, 1 %; kohl-rabi ves, 1 %; parsley leaves, 1 %; turnip leaves, 1 %; French beans, 5 %; ons, 2 %; leeks, 2 %; turnips (roots), 3 %.

o - **Utilisation of Cherry By-products.** — RABAK FRANK, in *U. S. Department of Agriculture, Bulletin* No. 350, 24 pp. Washington, D. C., March 10, 1916.

In the North Atlantic, North Central and Western States of the North erican Union, the cherry preserving industry is extensively developed, l enormous quantities of unutilisable fruit, stones and juice are turned , which are at present wasted, though it would be possible to convert n into products of great commercial value.

According to the 13th census of the United States, in 1909, the produc-n of cherries was 271 597 bushels in the State of New York, 338 945 hels in that of Michigan, 81 340 in Wisconsin, and 501 013 in California. e present production is no doubt very much greater. About 80 % of crop is converted into preserves.

Of the two by-products, stones and juice, of the cherry preserving and making industry, the stones have the greater commercial value; they esent about 15 % by weight of the cherries. The writer calculates t in 1914, 1 400 tons of them were produced in the Union. The juice ich comes out together with the stones when the latter are removed is mated at about 70 gallons per ton of cherries. Consequently the quant-lost is approximately 112 000 gallons per year.

As is evident from the experiments made by the writer, it is possible means of solvents to extract from the stones of crushed cherries 8.3 % of tty oil (pit oil); or they can be broken, the kernels taken out, and from latter by hydraulic compression about 30 % of fatty oil (kernel oil) racted. The resulting oil cake steeped in water and afterwards distilled a current of steam, furnishes about 1 % of a volatile oil; the residue of s distillation, when reduced to flour, may be used for cattle feeding.

Of the two above mentioned oils, the fatty oil is light golden yellow in our; it has a bland and agreeable odour, and a fatty taste recalling that the nut. It does not differ essentially from the oils of sweet almonds, aches or apricots; it should therefore have a commercial value approach-theirs, and be capable of the same uses, namely, pharmaceutical, food, p manufacture, etc. The volatile oil is for all practical purposes equal hat of bitter almonds, and may be put to the same uses in pharmacy, fumery, manufacture of sugar-almonds, etc.

Table I sets out the physical and chemical characters of the fatty pit (extracted with ether) and kernel oil of cherries; Table II, the character-s of the volatile oil; and Table III the composition of the oil cake.

TABLE I. — *Physical and chemical characteristics of fixed cherry oil.*

	Stone oil		Kernel oil
	crude	refined	
Specific gravity at 25°C.	0.9019	0.9137	0.9092
Index of refraction at 25°C.	1.4635	1.4641	1.4635
Freezing point	11° to 12° C	12° to 12°.5 C	13° to 13°.5
Neutralisation index	192.4	179.7	180.8
Iodine index	99.9	93.7	92.8
REICHERT-MEISSL figure	6.32 %	3.665 %	4.72 %
Soluble acids (reckoned as butyric acid)	1.22 %	0.473 %	0.469 %
Insoluble acids	99 %	92.5 %	92.8 %
Acetyl value	20.3	3.45	12.67
Non-saponifiable	2.45 %	1.12 %	0.44 %

TABLE II. — *Physical and chemical characteristics of volatile cherry oil*

	Oil extracted from the pit oil cake	Oil extracted from kernel oil cake
Colour	light yellow	golden yellow
Smell	pleasant, strong, bitter almond	pleasant, characteristic
Taste	sweet, very tart	sweet, very tart
Specific gravity at 4°C	1.050	1.012
Hydrocyanic acid	4.21 %	7.94 %
Benzoic acid	81.53 %	67.95 %

TABLE III. — *Composition of cherry kernel cake (after extracting the fa oil and the volatile oil, and dessiccation).*

Moisture	1.06 %
Ash	3.94
Protein	30.87
Nitrogenous substances	42.13
Cellulose	8.60
Ethereal extract	13.10

The writer calculates that the United States might produce each yea *a*) 268 000 lbs of fatty cherry oil, of a value approximate to that of peac oil, which has ranged from 22 cents per lb in 1913 to 45 cents in 191 *b*) 6 000 lbs of volatile oil of a value close to that of the oil of bitter almond which in January 1916 was quoted at 9.25 to 11 dollars per pound; *c*) abo 300 tons of distilled oil cake flour.

The juice obtained on extracting the stones is a light red liquid, with a ste and smell characteristic of the cherry. 1) By neutralising the acidity the juice with milk of lime, and afterwards filtering and evaporating, a rup is obtained of an agreeable, sweet, slightly tart flavour. The yield syrup is about 20 % of the juice. 2) By fermenting the juice and afterards distilling it, 4.6 % of alcohol of 95 % strength by volume is obtained. By concentrating the juice with an addition of pectine or other gelatinous bstances and sugar (1 lb of sugar per 1 200 cc. of juice), an excellent jelly made.

If the whole of the juice turned out annually in the United States were nverted into one of these three products, there would be 5 000 gallons f alcohol, or 21 000 galls. of syrup, or 85 680 galls. of jelly. In view of he large demand for these last two products, their manufacture would ndoubtedly be the most profitable.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

627 - **The Dairy Industry in Argentina and Plans for its Future Development.** — BERGES PEDRO, in *Anales de la Sociedad Rural Argentina*, Year LI, Vol 4, pp. 81-131, 21 figs. Buenos Aires, March-April 1916.

This work received a prize in a competition for an essay on scientific griculture, livestock and agricultural industries, organised by the "Sociedad rural argentina" in connection with the International Exhibition of griculture in 1910. It deals with the following subjects: the present state f the dairy industry, sanitary inspection; control of the quality of milk ntended for human consumption and for butter making; economic returns f the dairy industry, comparison of the conditions of this industry in Arentina with its conditions in those countries where it has attained its greatst development; methods to be adopted in order to effect reliable and rapid rogress.

I. - ORIGIN AND PRESENT CONDITION OF THE DAIRY INDUSTRY IN ARTINA - (a) *Production and consumption of milk and dairy produce.* Until 4, the milk products were so limited in quantity that there was practlly no necessity to export. In that year exportation to England and nce began, and afterwards to Brazil, Paraguay, Uruguay, Bolivia, lgium and Italy. From 1894 to 1899, there were exported in all 3 044 ns of butter. The figures for the following year are set out in table I. This ble shows that during the five-year period 1902-1906, the dairy proucts industry in Argentina underwent some development, which was folwed by a retrogression in the following five years, although the country sesses 15 million cows, of which little more than 2 million were classas dairy cows in the cattle census of 1908. Thus, from 1905 onwards, e exportation of condensed, sterilised and desiccated milk is seen to disapar from the statistics.

During the period 1903-1908, the consumption of butter in Argentina mained stationary; that of cheese increased by 3 2000 000 kg. though the rresponding increase in the national production was only 087 000 kg. Durg the period 1903-1912, the consumption averaged 700 gr. of butter and 50 gr. of cheese per inhabitant per year. Condensed milk and malted lk are furnished almost exclusively by importation, which is con-

tinuously growing. Comsequently, while the national consumption of milk products undergoes continuous increase, the manufacture of cheese and condensed milk is falling off and becomes more and more incapable of meeting the need.

b) *Extension of the industry in the country.* — Dairies are concentrated in the environs of the capital of the Republic and in the provinces of Buenos Aires, Entre Rios, Santa Fé and Cordoba. In 1907, which is the most recent year for which statistics are available, there were in Argentina 409 dairies, 29 butter factories, 85 cheese factories and 56 mixed establishments, of which 330,23,69 and 37 respectively were in the province of Buenos Aires, including the capital. The total quantity of milk treated in these establishments was 206 822 196 kg. of which 173 684 354 kg. in the city and province of Buenos Aires. The number of establishments nearly doubled from 1903 to 1908. It is on the increase in all the provinces, particularly those of Buenos Aires and Santa Fé.

TABLE I. — *Export and import of dairy products in Argentina during the period* 1900-1915.

Year	Exports				Imports			
	Butter	Cheese	Casein	Condensed sterilised, and powdered milk	Butter	Cheese	Condensed milk	Malted milk
	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
1900	1 056 000	856	—	—	—	1 373 882	—	—
1901	1 051 000	1 349	—	—	—	1 411 222	28 213	—
1902	4 125 000	6 520	94 074	—	120	1 639 682	27 312	—
1903	5 330 000	3 869	319 614	—	—	1 129 364	31 555	—
1904	5 294 000	7 459	1 694 883	31 530	—	1 845 769	43 894	—
1905	5 393 000	2 452	3 020 000	8 275	180	1 920 790	58 793	—
1906	4 405 000	285	3 081 000	...	—	3 313 343	133 185	92 771
1907	3 035 000	950	2 035 000	—	514	3 295 688	175 228	113 078
1908	3 550 000	1 000	2 058 000	—	345	3 667 612	155 655	135 331
1909	3 993 000	0	2 775 000	—	35 050	4 030 057	268 359	171 014
1910	2 876 000	367	2 973 000	—	—	4 325 476	278 368	143 171
1911	1 396 000	518	2 169 000	—	—	4 919 437	344 605	207 241
1912	3 677 000	1 942	3 501 000	...	—	5 374 584	348 028	224 071
1913	3 784 000	7 342	3 446 000	—	—	5 045 040	437 042	177 571
1914	3 482 000	3 727	2 925 000	—	...	3 834 367	259 184	138 991
1915	4 623 000	6 053	2 608 000	—	—	3 313 959	208 008	92 114

II. — SANITARY INSPECTION OF MILK PRODUCTION AND BUTTER MAKING. — The sanitary inspection of milk, as organised in the great dairy

ustry countries, does not exist in Argentina. Some municipalities alone, ıch as those of Buenos Aires, Rosario, Mendoza and Cordoba, have intro- uced compulsory tuberculin inoculation in city cow sheds(" tambos ") ; ut as only the municipality of Buenos Aires grants an indemnity for the nimals lost through this practice, this inoculation causes great injury to ıw keepers. The latter often attribute disease to the inoculation, and op- ose the use of this preventive treatment. As regards rural cow sheds, ıberculin inoculation was imposed by the order of the 16th December 1889 nd the additional decree of the 27th May 1901. These enactments were t aside by the General Direction of Health in consequence of a petition om the Argentine rural Society, as the manner in which they were applied as not in keeping with the precepts of hygiene. The general sanitary police gulations, approved by decree of November 1906, conferred on the live- ock division of the Department of Agriculture the right of inspection in l that related to this branch of production. Articles 41 and 42 provide iat all cow sheds where milk is produced and treated may be inspected ; the above Division, for the purpose of sampling milk and subjecting it bacteriological analysis. All the establishments in whose products the icillus of tuberculosis has been found are compelled to pasteurise the milk ld or handled by them. Nevertheless, so far, this enactment has not been nforced.

On the initiative of DR. BALDOMERO SOMMER, the municipality of uenos Aires in February 1910 enforced an order promulgated on the 13th ecember 1907, declaring " hygienisation " of milk intended for consump- on in the city of Buenos Aires to be compulsory. The order gives the idest possible sense to this term " hygienisation ". It was cited by way of ample to other towns at the international Refrigeration Congress held at ris in 1908.

In Buenos Aires, the death rate for children below one year was,in 89, 19.3 % of the children born viable ; in 1909 it had fallen to 9.9 %, ich diminution the writer attributes to the hygienic control of infant od.

An order of the Direction of Health of La Plata inposes very strict super- ion over factories of dairy products employing steam plant.

Cream is not subjected to any sanitary measure.

III. — TESTING THE QUALITY OF MILK AND BUTTER MAKING. — An spection of this kind is only adopted by the municipalities of Buenos Aires d Rosario. The most frequent adulterations are watering and skimming. ıe Author mentions a curious method of effecting skimming when the lk is being delivered ; the milkman places a skimmer beneath the seat his cart, the blades being driven by means of a belt which takes its ovement from the wheels.

The decree of the 4th October 1904 provided inspection for butter manu- cture and the " Comisión nacional de Lechería " in July 1905 submitted a heme for regulations under this decree. It limits inspection to the factories butter for exportation; the decree has never been enforced.

The absence of supervision of the quality of milk and of butter mak-

ing in Argentina are said to be a considerable hindrance to the progres of this industry.

IV. — Economic results obtained by the Dairy industry in the Argentine Republic. — According to official data, the cream and chees yield of milk and the butter yield of cream are as follows, being the aver ages for the years 1903 and 1905-1907 :

Cream yield of milk	7.25 %
Butter yield of cream	51.35 »
Cheese yield of milk	9 »

The quantity of milk produced per cow is very variable. In urba cow-sheds it is 2.64 galls. per day or even more, and for some cows goe up to 4.4 galls. In rural cow-sheds it averages 1.3 to 1.5 gallons, but here to cows are found yielding 4.4 to 6.6 galls. According to M. Lahitte (1903), th average production of the country is 0.77 galls. per dairy cow, with a butte yield of 3.5 %. On the whole the butter yield is good, but the milk yield i low. This disadvantage, however, is partly set off by the large number o cows available and the little attention required by dairy cows. The machine used are of the most improved types. The butter ranks fifth on th London market, after Danish, French, New Zealand and Dutch products this is due to the length of time for which it is cold-stored in transit.

No form of co-operation in the dairy industry exists. The writer ad vises the installation of co-operative dairies in the distributive centres i order to reduce the costs of carriage by railway and taxes on dairies, while at the same time ensuring supervision of the quality of the products.

V. — Considerations on the Dairy Industry and Dairy Pro ducts in certain countries. — The writer studied this industry i Denmark, Holland and Siberia, and he arrives at the result that: 1) these countries owe their progress to co-operation, and Siberia also to Govern ment action, which has enabled that country to gain within a space o ten years the second place in the world's output of butter; 2) the cattle stock of these countries is inconsiderable if compared with that of Argen tina, which proves that it is not necessary to have a large number of cows in order to produce butter ; 3) in Siberia, cows are badly fed and neglected from October to March, and drought is frequent. The writer notes this fact, because in some quarters the want of development of this industry in Argentina is attributed to insufficient feeding ; 4) in order to obtain 1 lb of butter, there is required in Denmark 26.5 lb, of milk ; in Holland, 30, in Siberia 22 ; in Argentina 28.

VI. — Industrial Capacity of Provinces and Territories in Ar gentina in reference to Output of Milk and Milk Products. — *Quantity of Livestock and Conditions of Environment.* — In Table II par ticulars are given as to the number of farm properties with an area of more than 24 acres and the number of dairy cows " vacas de cria " (breeding cows) and other milk yielding animals (ewes, goats and camels) in the provinces and territories of the Republic.

Cheese-making finds favourable conditions in the region of the Andes d the territories of Pampa, Neuquén, Chubut, Río Negro, Santa Cruz d Tierra del Fuego, because cool animal housing quarters are available ring the greater part of the year.

TABLE II. — *Distribution of Milk-yielding Animals in Argentina (Livestock Census of 1908).*

	Farm properties over 24 acres	Dairy cows	Breeding cows	Sheep	Goats	Camels
Provinces						
nos Aires	45 023	656 640	4 491 588	21 109 609	11 335	—
ta Fé	27 104	186 510	1 146 657	596 411	35 596	—
re Rios	13 893	203 800	1 533 524	3 936 902	31 748	—
rientes	10 394	206 165	2 388 052	1 805 745	29 978	—
tiago del Estero	4 359	88 107	222 566	435 839	705 127	—
doba	25 896	217 233	898 164	1 245 764	810 831	—
umán	6 443	55 098	114 107	82 720	101 394	—
ta	3 453	71 019	209 813	194 590	217 054	29 700
uy	4 472	8 152	46 456	535 447	133 656	42 516
amarca	4 633	26 506	101 403	97 524	311 548	828
ja	3 146	59 873	163 140	77 281	359 811	—
Juan	1 658	3 156	31 975	61 800	90 796	—
Luis	5 485	59 876	224 399	535 447	468 216	—
doza	2 325	22 968	142 774	187 526	205 427	—
Territories						
ubut	—	27 846	157 305	1 212 501	—	—
quén	—	26 195	82 225	503 221	170 919	—
pa	—	24 465	205 057	3 005 807	113 161	—
Negro	—	25 025	128 420	3 140 466	76 698	—
ta Cruz	—	1 639	10 075	1 371 324	582 964	—

Feeding of Dairy Animals. — In 1908 Argentina possessed 6 728 876 ctares of artificial grasslands, of which 4 656 707 ha. were under lucerne l area exceeding that of Denmark,) and in addition the immense rich na-al pasturages. It also exports many concentrates (bran, oil cakes, etc.), nsequently the production of cheese exeeds the quantity required for the ntry.

MEASURES CALCULATED TO PROMOTE THE PROGRESS OF THE DAIRY IN-STRY. — The Author in this connection, reprodnces the opinions of Messrs. BSON, LAHITTE, BERGÉS, FYNN and PEREZ. They are unanimous in think-

ing that co-operation must be developed and an immediate demand mad for: 1) the reduction of the carriage rates and the provision of cold storag wagons in sufficient quantity (LAHITTE, BERGÈS and FYNN); 2) the aboli tion or reduction of taxes (LAHITTE, BERGÉS, FYNN AND PEREZ); 3) the in spection of milk intended for consumption (BERGÉS) and butter (LAHITTE BERGÉS and PEREZ); 4) the sanitary inspection of cow-sheds (BERGÉS) 5) the foundation of practical schools for the dairy industry (LAHITTE an BERGÉS); 6) shows of animals and products (BERGÉS, FYNN, and PEREZ).

The writer is in favour of cooperation and even of compulsory co-opera tion, as likewise of the establishment of mixed co-operative societies of pro ducers and farmers. He studies in detail the question of the establishmen of co-operative societies in each of the milk-producing provinces, with geo graphical maps of the latter; he also treats of the scientific, economic an legal bases for the "hygienisation" of milk, and concludes by setting ou a draft law which embraces all his desiderata.

Practical Results. — The writer presented his essay in 1910 and from that date to 1916 he has secured: 1) the establishment in January 191 of a dairy industry bureau in the General livestock Direction; 2) the pro mulgation on the 20th August 1915, of a law declaring the "hygienisation" of milk compulsory in every town with more than 10 000 inhabitants, an proposing the establishment of mixed co-operative societies; 3) the holdin of a series of lectures the result of which was the creation of 5 supervisin and inspecting societies, 2 of which in particular are in operation; 4) th promulgation of a decree under date of the 17th December 1915, whic establishes national inspection of dairy products; 5) the publication by the Dairy Industry and Refrigeration Bureau of an edition of 20,000 copies o a booklet in which the dairy qualities of cattle are discussed; 6) the creatio of educational provisions for the improvement of the dairy industry, in the faculty of medicine and veterinary science of Buenos Aires, and in a large number of schools of agriculture.

1022 – **Influence of Mechanical Milking with the "Omega" Milker on the Bacterio logical Composition of Milk.** — BURRI R. and HOHL JOH., in *Landwirtschaftliches Jah buch der Schweiz*, XXXth year, Part 2, pp. 241-255. Berne, 1916.

The experimental Station of Berne-Liebefeld has carried out a series of experiments in mechanical milking with the "Omega" milker, with a view to determining not only the economic desirability of mechanical milk ing under the conditions peculiar to Switzerland, but also its influence on the milk production of cows (1) and that exerted on the bacteriological com position of the milk, as compared with hand milking.

The report submitted by the writers is preceded by a short biblio graphical statement on the question, and gives in detail the results of the bacteriological analysis of samples of milk obtained under the following conditions:

1) Mechanical milking on the methods usually employed for clean ing the milking appliances;

(1) See *B.* 1913, N° 1073

2) Hand milking on the methods generally practised ;

3) Mechanical milking, steam being used for cleaning the appliances der special laboratory conditions.

4) Mechanical milking, using hot solutions of caustic soda for clean- the appliances under normal conditions in the cow-shed and without the of steam ;

5) Hand milking with special methods of cleaning.

The results of the bacteriological analysis comprising the determina- n of the number of bacteria per cc., the presence of gas-producing bacte- of the group of *Bacterium coli*, and their behaviour under the fermenta- n test, led the writers to the following observations :

1) The quality of the milk as regard the species and number of the cteria it contains, varies within much wider limits in mechanically milked in in the hand milked article, as an incomplete cleaning of the apparatus ilitates the accumulation of a large number of bacteria which, at the lowing milking, easily get into contact with the milk which is almost free m germs on leaving the teat. This deteriorates the keeping properties of milk, and the latter must be regarded as of inferior quality both from the int of view of health and that of the dairy industry.

2) On the other hand, by using special methods to ensure the utmost anliness of mechanical milking appliances, there is obtained on this me- od a quality of milk which, with respect to purity and keeping properties d the number of bacteria it contains, answers all requirements ; it is perior to any hand milked product, on condition, of course, that the ap- iance is applied to a perfectly clean teat.

3) In order to obtain an equally high degree of purity with mechan- al milking, it suffices to use a hot solution of 0.2 % strength of soda (47 50° C) when cleaning the appliances inside and out which the brush, flush- g them out before and after with a jet of clean water.

4) In view of the facility with which mechanical milking may cause eterioration in the quality of milk when the above rules are not constantly nd strictly, followed, it is desirable, both in the interests of hygiene and he dairy industry, that wherever the introduction of this method of milk- ng is justified from the economic standpoint, it should only be entrusted to onscientious and trustworthy persons.

23 - **A New Defect in Milk Caused by *Bacterium Lactis Aerogenes* Esche-** **rich.** Duggeli Max, in *Zeitschrift für Gärungsphysiologie*, Vol. 5, No. 5, pp. 321-340. Leipzig, 1916.

The writer received for examination 2 samples of bottled milk suffering om a hitherto unknown and very pronounced defect, although the sam- es reached the laboratory only 48 and 60 hours after milking. They came om a model cow-house of 36 cows producing best quality milk, ob- ined and handled with the utmost cleanliness, afterwards filtered, cooled 12-14°C and bottled for forwarding to the consumers. When the milk om this shed had been kept for some time, a bitter taste was observable, ogether with a typical rancid smell, especially noticeable when boiling the

milk ; and this fault became more strongly pronounced as the time of kee ing was lengthened.

All atempts to discover the presence of bitter substances failed.

The ration of the cows was made up of good hay and crushed barle not very fresh it is true, but of normal bacteriological composition. C studying the fresh milk of the 36 cows separately no result is obtained, b by keeping the different specimens of milk it was detected that the defe was due to one cow with a diseased teat, an old animal which had been i milk for a year and a half.

A thorough bacteriological study of the above 2 specimens of milk w made, all kinds of cultures being prepared. The writer succeeded in isola ing a bacterium belonging to the group *Bacterium lactis aerogenes* Escherich but differing from the stock form of *Aerogenes*, and he considers this to b the cause of the defect in question. It not only gives rise to abnormal sme and taste in the milk, but also possesses the property of making glucos bouillon very ropy. Furthermore, even in the presence of *Bacterium Güntheri* L. et N., it prevents the coagulation of the milk. On cultivatin the bacterium producing the defect in question on lactose agar, the carac teristic taste and smell disappear, but they can be made to reappear in pa by afterwards cultivating the bacterium in a suitable medium (decoctio of teat substance).

1024 – **Manufacture and Composition of Bulgarian Cheeses.** — ZLATAROFF, A. S. (Com munication of the Laboratory of the University of Sofia), in *Zeitschrift für Untersuchun der Nahrungs- und Genussmittel*, Vol. 31, No. 12, pp. 387-394. Münster i. W., June 15, 1916

In Bulgaria, in addition to the cheeses peculiar to the country, foreign cheeses (Gruyère, Roquefort, Chester, etc.) are manufactured, but their production does not exceed 5 % of the total output. The bulk of the latter is made up of the specific cheeses of the country, " Bulgarian cheese " proper and " Kaschkawal ", which are described below.

1) *Bulgarian Cheese.* — Belongs to the group of ordinary white cheeses and the sub-group of salted soft cheeses ; it is prepared from ewe's milk but in a few rare cases also from goat's and buffalo's milk. The milk is worked immediately after milking at a temperature of 30 to 35°C., often in very large quantities coming from entire mountain flocks. The milk after milking is passed hot through a cloth filter into large cans, and either natural rennet, or, according to recent practice, artificial trade rennet, is added. In these cans, which have wooden lids and are surrounded by a woollen cover to retain the heat, the renneted milk is allowed to remain 1 ½ to hours according to the outside temperature. After that time the whole o the milk has curdled. The curd is thoroughly stirred up for some minutes and then poured into a cloth filter to remove the whey. The cloth is hung up with its contents and the whey drained off, after which the curd is put into wooden moulds where it remains for 2 to 3 hours. After this operation the curd is cut up into regular cubes of 15 to 20 cm. each side which are well salted and arranged in layers in wooden vessels. On each layer vine leaves are placed, and the whole is afterwards pressed down with a stone. The vessel is kept in a cool spot, the whey runs off from the pieces of cheese, and

er a time the whole of the cheese lies in a bath of whey, in which it ri-
ns; the duration of the process of ripening varies according to the cheese
aker. On the market, cheeses of more or less advanced stage of ripening
e found.

The finished cheese put on the market is completely white and is soft
d friable. Its taste, slightly tart and piquant, varies according to the
gree of ripening and the manner of keeping the finished product (whether
t on the mountain, in the valley or in town). The older the cheese the
re it tends to take on a consistency resembling that of hard butter, so
at it can be easily spread on bread. After keeping 6 to 8 months the
eese partly loses its taste; if it is made with skim milk its taste is not so
asant. This latter method is regarded as fraudulent, although there is
law prohibiting this cheese being sold as though made from full cream
lk. A good cheese should never contain holes.

2) "*Kaschkawal*". — This belongs to the group of cooked cheeses and
e sub-group of solid and sour descriptions. The raw material (milk) is
t through the same treatment as in the manufacture of ordinary Bulga-
n cheese, but always consists of ewe's milk and never buffalo milk.
ter passing through the filter the mass of curd is wrapped in the cloth and
e latter is twisted so as to wring out the whey; to promote drainage the
sein is also pressed by hand. These operations distinguish "Kaschka-
l" manufacture from that of ordinary Bulgarian cheese. When the
ey is drained off, the casein is put into wooden moulds, then thoroughly
turated between the fingers; the cloth is twisted a second time and the
rd once more pressed by hand to force out the rest of the whey.

For this secondary fermentation the curd, freed from the whey, must
main in the cloth for some days. If the weather is hot, the secondary
mentation takes from 3 to 5 hours; if cold, 2 days. The process is
lged according to the colour of the mass which should be a light yellow,
d the content of "eyes", which must have a diameter amounting to 1 cm.
fermentation takes place slowly, owing to low outside temperature, whey
poured into the curd.

On completion of the secondary fermentation, the casein is cut up
o long pieces of an average weight of 50 to 60 gr. which are placed in a
ter bath at 50-60°C.; they are left in this for 8 to 10 minutes and tho-
ghly kneaded by hand. The paste thus becomes spongy and is shaped
o balls weighing 1, 2, 5 or 7 kg., which are placed in metal moulds; here
y remain 3 to 5 days, cooling and solidifying.

When this operation is completed, the balls are taken out and salted,
l kept in layers. The cheese should be salted every day for 10 to 25
s, and is then kept in a well ventilated spot. The cheese is stored for
at 1 month until fermentation is completed.

"Kaschkawal" is found on the market under two names: "fresh"
schkawal which is offered for sale immediately after salting, and "old"
schkawal or the completely ripened article. The colour of Kaschkawal
ight yellow; the slightly tart flavour resembles that of original Gruyère;

TABLE I. — *Composition of ordinary Cheese and of " Kaschkawal "*

Constituents	Ordinary cheese 20 samples	« Kaschkawal » fresh, 10 samples	« Kaschkawal », 17 samples
Water	42.37 to 64.06 %	38.90 to 44.90 %	24.91 to 33.9
Proteins	14.08 » 27.51	21.84 » 27.40	19.06 » 27.4
Decomposition Products of proteins	2.20 » 5.88	2.12 » 3.62	8.08 » 11.1
Fatty substance	9.75 » 25.10	22.88 » 28.12	27.05 » 34.0
Total ash	3.45 » 4.94	2.90 » 4.38	4.99 » 7.7
Sodium chloride	1.10 » 3.12	0.20 » 1.68	2.02 » 4.2
Lactose, lactic acid, etc., by difference	0.27 » 6.05	—	—

TABLE II. — *Modifications of the proteins in " Kaschkawal " in course of ripening.*

Age of the cheese	Unaltered proteins	Water soluble protein
Fresh, on leaving the water bath	31.08 %	0 %
3 days after leaving the water bath	30.08	1.00
6 » » » » » »	29.12	1.96
10 » » » » » »	28.22	2.86
15 » » » » » »	26.78	4.30
20 » » » » » »	23.97	7.11
25 » » » » » »	22.31	8.69
30 » » » » » »	20.93	10.15
40 » » » » » »	20.20	10.80
60 » » » » » »	19.80	11.28

its consistency is very firm ; there are few holes or " eyes " in the body of the cheese (their diameter being 0.5 to 1 cm.).

The chemical composition of " Kaschkawal " was studied by the writer in the Laboratory of applied chemistry of the University of Sofia. Table I sums up the results of 27 analyses and shows that the composition of " Kaschkawal " generally resembles that of Dutch cheese.

The chemical composition of " Kaschkawal " was more thoroughly studied by determining the unconverted proteins and those which had become soluble in water, in reference to the different periods of ripening. These analyses (reproduced in Table II) were made in the uplands, where " Kasch

kal " is generally manufactured, according to samples from one and the ne piece of cheese. From them it may be concluded that the process of ening first progresses with fair rapidity, then slows down, and ends after days.

At the close of his work the writer gives some information as to the ional importance of cheese-making in Bulgaria. Before the Balkan s the total production was 22 to 25 million kilograms per year. The ater part of the cheese is consumed within the country. From 1907 to 1, the exportation of ordinary Bulgarian cheese attained the following ures:

Year	Quantity in kg.	Value in francs
1911	1 087 775 kg.	804 141 fr.
1910	543 105	415 358
1909	620 312	493 419
1908	456 160	338 676
1907	704 539	518 627

It is chiefly exported to Turkey (Constantinople), but also in small ntities to Egypt and Greece.

The production of " Kaschkawal " is less extensive. In the five-year od preceding the Balkan war it amounted to about 5-6 million kilo- ns. " Kaschkawal " is made in specially equipped cheese factories. From 1907 to 1911, exportation showed the following figures.

Year	Quantity	Value
1911	2 336 150 kg.	3 139 205 fr.
1910	2 073 150	3 276 501
1909	1 736 500	2 103 259
1908	2 083 114	2 136 317
1907	1 186 222	2 060 641

" Kaschkawal " is chiefly exported to Turkey, but small quantities go to Egypt and Greece.

Researches into the Content of Bacteria and Catalase in Hen's Eggs. — RUEL- ASS, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, o. 8-12, pp. 219-230. Jena, April 22, 1916.

These researches have demonstrated that in eggs free from bacteria ase is an original substance. It occurs both in fresh and in preserved

Its quantity, independently of the age of the eggs, varies from c. to 7.6 cc. per 10 cc. of substance.

In broken eggs, the quantity of catalase showed a reduction as early hours after breaking. In one case, however, it increased from 2.5 cc. cc.

The catalase contained in rotten eggs could not be determined by means JKMAN's fermentation tube without having been diluted. The diluted

catalase was diminished during the first 6 days when kept in an ice safe, after which the amount remained stationary.

All the eggs, with the exception of those in process of putrefaction were free from bacteria.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

1026 — **Farmer's Elevators in Minnesota, United States of America.**— WELD L. D. H. in *The University of Minnesota, Agricultural Experiment Station*, Bulletin 132, pp. 1-, University Farm, St. Paul, August 1915.

The movement which led to the establishment of farmer's elevators seems to have had its inception about 1890 in the State of Minnesota. Before that time, the grain trade (bulking, storage and forwarding) was in the hands of companies owning elevators along the railway lines (line elevator companies), having their principal office in towns such as Minneapolis and Chicago. At the outset, although these companies rendered great service to the grain trade, they showed themselves at times to be hard bargain drivers in their contracts with the growers from whom they bought the grain direct ; they also forced prices up and down according to their interests. Although these practices were perhaps not so current as is generally supposed, farmers, having got wind of them, became distrustful of the state of things. They therefore combined to erect co-operative elevators, the number of which rapidly increased, to the detriment of the elevators belonging to non-agricultural Societies or Companies. In 1906 there were 1 196 Company elevators in Minnesota as against 151 farmer's elevators. In 1911 according to the Railroad and Warehouse Commission, these figures changed to 777 and 300 respectively. This Commission regarded as elevators belonging to farmers those which styled themselves farmer's elevators, though in reality many pass under that name without really belonging to farmers.

On the 1st January 1914, an enquiry was opened by virtue of a law passed in 1913 by the legislative body of Minnesota, authorising the University of Minnesota to collect annual reports on the cooperative movement. According to this enquiry, at the 1st January 1914 there were 270, and at the 1st January 1915, 278 elevators in respect of which farmers held more than 50 % of the shares. The total business turnover done by the 270 agricultural societies existing in 1914 and owning elevators may be estimated at 830 000 000 ; these societies sell about 30 % of the whole of the grain sold by the farmers of Minnesota.

The enquiry laid down the bases on which an elevator may be considered as "co-operative". The three essential points in co-operation are the principle of the individual vote in resolutions (instead of the system of voting by which each member has a number of votes proportional to the shares he holds), limitation of the number of shares which may be held by one member, and distribution of profits rateably to the business transacted by the Society with each member. About one third of the Societies limit the interest paid on shares and distribute the profit balance in proportion to the business done by each partner. The interest paid on the shares ranges from 5 to 10 %. In other words, the rateable distribution of profits has not been that most commonly adopted, and where it has been adopted the society generally pays a higher rate on shares than the current interest

sequently farmer's elevators are not, properly speaking, co-operative ertakings in the true sense of the word.

The dividends paid by the Societies are of course very variabl.. In 3-1914, the position of these establishments was very prosperous. Of 161 Societies about which the writer possesses information, 64 paid no idends (20 of them losing money), 66 paid a dividend below 10 %, 18 a idend between 10 and 20 %, 8 between 20 and 30 %, and 5 a dividend eeding 30 %.

The managers of farmer's elevators were, at the beginning, often much ler-paid, which resulted in certain mishaps. At present the salaries of nagers range from $60 to $165 per month, with an average of $90. e reports received for 1912-13 show that in those elevators which e losing money the manager's salaries were about $10 per month less n those of the managers of profit-earning elevators. The managers are, the majority of cases (78.2 %), required to deposit security varying, ording to the elevators, from 1 000 dollars to 25 000 dollars.

The writer next gives indications on the cost of handling grain in ele- tors which is variable according to the amount of business transacted, as pears from the following figures :

Number of bushels handled	Cost of handling per bushel (Cents)
from 50 000 to 100 000	2.3
„ 100 000 „ 150 000	1.9
„ 150 000 „ 200 000	1.5
„ 200 000 „ 300 000	1.2
„ 300 000 „ 400 000	1.15

When farmers bulk their goods in their own elevators, they reduce the t of handling, and therefore get higher prices for their grain. Probably mer's elevators save those concerned about 1 000 000 dollars per annum Minnesota.

The farmers utilise their elevators for the purchase of the different ds they need ; this business is of very great importance in Minnesota. 1912-13 the purchases amounted to about 2 000 000 dollars, comprising al, flour, food, etc. : 63 % of the elevators engaged in the purchase of coal, % food, 10 % flour, 35 % binding string, 18 % seed, and 16 % salt. siness was also transacted relating to cement, agricultural implements, ber, fencing material (including iron wire fencing), and oil.

At the close, the Author gives advice as to the mode of organisation of Society and a specimen of by-laws.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1027 - **Researches as to Injuries caused by Lighting-gas to Plants.** — SORAUER PAUL, *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, No. 3-4, pp. 129-183, Stuttgart, June 1, 1916.

At the request of the Berlin Gas Works the writer made experiments the results of which are set out in the present work, on the damage caused to plants by lighting-gas. These experiments were conducted in the large parks of Berlin, which proved well adapted for the purpose.

The writer proposed in the first place to ascertain by experiment the character of the toxic effects due to lighting-gas. Hitherto the blue colouring of the roots was regarded as a satisfactory indication, but these experiments have made it clear that this phenomenon often gives a misleading result. Systematic experiments were begun in the spring of 1913, with *Prunus Padus*, *Ulmus scabra*, *Carpinus Betulus*, *Viburnum Opulus*, *Quercus pedunculata*, *Ulmus campestris*, *Urtica dioica*, *Syringa vulgaris* and a large number of ornamental plants.

In all plants suffering with gas poisoning it was observed in the first place that the chlorophyll was attacked, disappearing little by little. The process of assimilation and the formation of new organic substances, in spite of the presence of all factors of growth, are impeded in soil permeated with lighting-gas, and the plant utilises its own substance for intramolecular respiration. These phenomena indicate the existence of a process of asphyxia through the want of oxygen in the roots. If lighting-gas effectively acts on the roots, the consequence of intramolecular respiration also appears on the overground parts of the plant. That is why those parts of the leaf which receive the least sap (edges of the leaf) are the first to show discoloration or disappearance of the chlorophyll, and also why the first signs of withering (appearance of dry spots and edgings) appear on the edges of the leaf.

With the drying of the periphery of the green organs, and the reduction of evaporation, an excess of water is observed as a consequence in the lower parts of the stalk and roots of the plant. This phenomenon is noticed

e point where the parenchyma has the most powerful reaction, namely in e bark. The consequence is often wet rot and death of the base of the lk. This is the case of what is called "Lohkrankheit", the cause of ich is too large a supply of water through the roots.

Among the injuries caused to the leaves, the appearance of transparent ots rapidly spreading is characteristic in some large-leaved plants.

In an atmosphere of gas, transpiration falls off greatly for each gram of sh substance. If the plants have an abundant amount of water at the e of reduction of the evaporation coefficient, a great accumulation of ter takes place in the organs of transpiration. Under the influence of s accumulation it is observed in rapidly growing plants that the cells of e separation layer become gradually less coherent, and the result is the l of the leaf (in *Fuchsia*, *Begonia* and *Azalea*). In *Taxus* and other trees, lenticular swellings were observed on the roots in consequence of too large water supply.

5 - Studies on "Dörrfleckenkrankheit" (Dry spot Disease) in Oats (1). — SCHIKORRA W., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 18-25, pp. 578-586. Jena, June 19, 1916.

For the last two years it has been observed in Germany that growing ls of oats carried out in pots are liable to the appearance of a character- c disease often producing death of the leaves. In 1913-14 the disease eared to a limited extent only, not hindering the experiments, but such not the case this year, the oats becoming diseased both in pots and in open field; therefore the causes of the disease had to be studied.

It was found to be the disease called "Dörrfleckenkrankheit" of oats by USEN-HEIDE; it is distinguished by the fact that the leaves of the oats, r normal growth, show pale, greyish-yellow spots the tissues of which die, the leaves break. The disease is known in Upper Bavaria under the e of "Haftersucht" and in Sweden under that of "Graufleckigkeit" ats. The cause, according to NILSSON-EHLE, ERIKSSON, KRAUSE, etc. *colecotrichum graminis*, but recent experiments have shown that typi- "Dörrfleckenkrankheit" is a disease of the soil, often promoted by also uring with artificial fertilisers.

The writer made experiments on the outbreak of the disease by studying influence of manuring with artificial nitrogenous fertilisers: 5 experi- ital pots each containing 6 kg. of clayey-sandy soil were given a basal ure of 5.5 grms. of dipotassium phosphate, after which 0.5 gms. of nitro- per pot was added. As nitrogenous manure there were used, by way omparison with each other, pure nitrate of soda, sulphate of ammonia, , nitrate of urea, cyanamide, ammonium chloride, Rehmsdorf nitro- us manure (organic nitrogenous manure), ammonium bicarbonate, and double sulphate of ammonium and soda; 5 other pots received no genous manure and served as controls.

The observations made on the plants cultivated in these pots gave

(1) See also *B.* June 1914, No. 575. (*Ed.*)

a very different idea of the nature of the disease in each case. According to the degree of disease, the following results were obtained :

Oats very badly attacked :	Rehmsdorf manure meal.
Oats badly attacked :	Nitrate of soda, urea, nitrate of urea, ammonium bicarbonate.
Oats clearly attacked :	Double sulphate of ammonia and soda, cyanamide, sulphate of ammonia.
Oats hardly attached at all :	Ammonium chloride.

On adding 1 gram of nitrogen to the pots it was found that the nitrate of urea had given a better result than the nitrate of soda. According to the degree of the disease there is obtained :

Oats very badly attacked :	Rehmsdorf manure meal, nitrate of soda.
Oats badly attacked :	Urea, ammonium bicarbonate.
Oats clearly attacked :	Nitrate of urea, cyanamide.
Oats weakly attacked :	Sulphate of ammonia, double sulphate of ammonia and soda.
Completely healthy oats :	Ammonium chloride.

It will be seen from these facts that even the very best fertilisers ma often be the most injurious to the plants.

The table of crops shows that the best yield was obtained throug ammonium chloride, because it checked the progress of the disease, whi the best nitrogenous manure, nitrate of soda, gave a less satisfactory resul It should be noted that at the beginning of growth, before the onset of th disease, the plants manured with ammonium chloride were not the best i appearance, but later on there was a change in this.

The writer has also studied the influence of various potassic and pho phatic manures and lime on the " Dörrfleckenkrankheit », by manurin pots with doses of these fertilisers. The experiments were continued fo 5 consecutive years. They showed that a heavy lime manure had assiste the onset of the disease.

In another series of experiments the writer mixed the ordinary light so of a field successively with marsh soil, marl, clay and straw, and then stu died the relations between these additions and the outbreak of the disease

On the plot which had received marsh soil the oats were most clearl attacked ; on those which had received marl and on the control plots th disease was not so strong ; on the plots which had been given straw manur the plants showed but few spots ; finally, on the plots which had receive clay the plants were hardly attacked at all. These observations agree with those obtained by CLAUSEN, TACKE, HUDIG and ZIMMERMANN on ordinary sandy, marshy and clayey-silicious soil. It is difficult to give a precise ex planation of this phenomenon, but probably the temperature of the soi plays a part, a high temperature being favourable to outbreak of the disease

As regards the relations between artificial fertilisers and the appearance of the disease, the writer concludes that the disease is promoted by physio

gically alkaline manures such as Chilean nitrate, basic slag and lime. It ay therefore be controlled by manures with a physiologically acid reaction, ich as ammonia, potash salts and superphosphate. This hypothesis is orn out by the writer's experience of soils that are most favourable to the isease.

It is intended to continue the experiments.

329 – **The Possibility of Recovery of the Slips of a Vine suffering from "Bramble-Leaf"** (1). — PANTANELLI E., in *Le Stazioni sperimentali italiane*, Vol. XLIX, Part 5-6, pp. 219-296. Modena, 1916.

Experiments carried out for the purpose of ascertaining:

1) Whether the wood taken from vines suffering with "Bramble-f (court-noué" or "roncet") produces in all cases plants and vines owing the same disease;

2) Whether vine plants affected with bramble-leaf can be cured by table treatment or under favourable conditions of growth;

3) Whether such recovery is real and durable or apparent and nsitory.

In the course of these experiments the following facts were brought light:

Slips taken from vines affected with this disease and planted in any soil gan their spring growth by forming buds which exhibited bramble-leaf.

The disease of the shoots, slips or plants consisted mostly in deformation the leaves (laciniation, twisting of the toothed edges, spotting in the se of Riparia and Rupestris, asymmetry and formation of blisters on e leaves in Berlandieri) and in a strongly pronounced internodal distor-on of the branches. In the spring, above all in the case of Rupestris, Ri-ria, 420 A, the leaves showed pale or blackish spots, but never to the same tent as in the parent vines suffering with mosaic bramble-leaf. Leaves which d grown from the month of May onwards, although deformed, were ge-rally without these spots, which sometimes reappeared on the last leaves e growth of which had taken place at the end of autumn (November-cember): they then also appeared on some of the last leaves of plants maining healthy in appearance. These symptoms are identical with those oduced by rapid falls of temperature during the formation of the buds.

The slips taken from vines attacked by bramble-leaf often recover in e course of growth; precisely the same thing, for that matter, is observed the parent vines, that is to say, after a first stunted development the bran-es form internodes which grow continually longer and end by being of rmal form; the leaves were less and less deformed and their shape and mensions at last became normal.

It is a rare thing for slips taken from vines suffering with bramble-f not to have stunted buds suffering from the disease at the outset. hen this case did occur, especially in Berlandieri and its hybrids as well the European-American crosses, it is explained by the fact that the slip s been taken from the non-diseased tip of a branch.

(1) See also *B.* July 1913, No. 685. (*Ed.*)

As a general rule, the disease is reproduced on the first buds of the slip with the same intensity and the same appearance as it had exhibited in the previous year on the corresponding leaves and the internodes of the branch of the parent vine.

Furthermore, the experiments described in this work have brought out a number of shades and gradations of this phenomenon of preservation of bramble-leaf in the layer-slips so much so as to point to the possibility of an effective, slow and gradual cure of plants taken from diseased vines.

The slips of the Berlandieri and their hybrids, the European-American hybrids and Riparia, above all, recovered more rapidly during the summer than the slips of Rupestris, and among the latter varieties the most liable to the disease are the most difficult to cure. For instance, the proportion of plants which recovered in summer, all conditions of soil and rearing being equal, is less in the case of the varieties of Rupestris du Lot than of Rupestris metallica.

Furthermore, the more readily the diseased slips take root in a given soil, the more easily they recover. The recovery which occurs in summer is proportional to the root growth, in respect both to the number and thickness of the roots put forth by the slip. It follows rather than precedes the production of root apparatus sufficing for the needs of the aerial portion. The question involved therefore is that of an abundance of roots relatively to the size of the slip. For instance, a plant with fine stalk recovers in summer even if it has only few roots, while a slip as thick as those often taken at the base of branches, needs the growth of numerous roots before equilibrium is established between the demands of the foliage and the potentialities of the absorption apparatus.

Whatever the factor influencing the production of roots, it also influences the recovery of the diseased branches in summer. Thus the treatment of the slips with different baths at the time of planting very much facilitated their recovery, not owing to any disinfecting action, but because some of the substances applied stimulated exchanges favourable to a greater root production. In 1907 the best results were obtained with ferrous sulphate, phenol and hot water; in 1908, with phenol, ferrous sulphate and hot water; in 1909, with formalin, phenol, acids and hot water; in 1910, with ferrous sulphate, sulphuric acid and lysol.

The difference observed between the behaviour of diseased slips planted on propagation beds already partly exhausted by use and those planted on beds which had been fallowed, was still more interesting. In the latter case the diseased slips at once formed a strong root system, while in partly used up soil the diseased slips struck root very poorly, and in summer there was little or no recovery.

The writer has made trials of different crops with a view to finding out which is most adapted to rest the fatigued soil for the purpose of vine-growing; leguminosae contributed largely to better rooting of the slips, and on the beds where bean ensilage had been carried out the proportion of recoveries in summer was usually found to be higher.

	Exhausted propagation bed				Fallowed propagation bed			
	Slips planted (diseased)	Branches			Slips planted (diseased)	Branches		
		healthy	cured	diseased		healthy	cured	diseased
upestris du Lot . . .	2 000	0	395	276	1 000	48	213	126
» metallica . .	1 000	45	229	136	»	86	291	48
paria Gloire . . .	»	40	289	113	»	123	338	27
»	»	65	194	115	»	158	282	56
amon × Rup. G . . .	»	72	234	179	»	163	396	62
handleri R. 1. . . .	»	0	0	10	»	20	39	13
» » 2. . . .	»	3	44	42	»	37	129	17
A	»	0	18	27	»	49	246	20
. . . . .	800	22	108	124	»	73	348	42

It remains to be seen whether this recovery taking place in the summer only temporary, or whether in reality the vines infested with bramble- if tend to recover in the course of time; 200 affected slips of Rupestris du it taken from the nursery bed of Noto (Sicily), were planted in 1909 at Tro- so, near Lake Maggiore, in a soil which had before been put down to vine. the spring of 1909 there were rather frequent late frosts there, and the al- ady developed and barely opened buds remained covered with snow for veek. The first shoots which came out were very much curled, but in summer the branches recovered completely. In the following year, to. the spring buds were still slightly deformed, but the vines showed orous growth in the summer. In 1912 not the slightest trace of bramble- f could be discovered any longer, and the growth was extremely vigorous.

This result would seem to prove that slips suffering with "court-noué," n those of the most sensitive stock, such as Rupestris du Lot, can recover m this disease in a few years if placed under conditions entirely favourable their taking root.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

- New Species of Parasitic Fungi discovered in Canada. — DEARNESS JOHN., in *Myco-* GENERALITIES.
l., Vol. VIII, No. 2, pp. 98-107. Lancaster, Pa., 1916.

Among the species described the following deserve particular mention: 1) *Placosphaeria cornicola* n. sp., on the living leaves of *Cornus Nut-* Aud., in the island of Vancouver (British Columbia), September 1914; diseased parts take on a bright red and afterwards a yellow colour while y black stromata appear and tend to run together; 2) *Cytodiplospora*

parallela n. sp., on *Acer nigrum* Michx., at Byron (Ontario), October-November 1903; stromata containing 5 to 15 pycnidia, scattered irregularly or arranged in more or less continuous parallel lines; 3) *Ascochyta Achlydis* n. sp., on *Achlys triphylla* D. C., in the island of Vancouver, 9th June 1915; on the leaves attacked spots are observed, some of which are small in size (2 mm.); others, fewer in number, are 1 cm. in diameter and have a dark red border; 4) *Diplodia Nuttalliae* n. sp. on *Nuttallia cerasiformis* Torr. and Gr., at Victoria (British Columbia), April 1915; the pycnidia are placed round the lenticels, which likewise serve as a passage for the parasite; 5) *Septoria adenocaulonis* n. sp., on leaves of *Adenocaulon bicolor* Hook, in British Columbia, May 1915; 6) *S. angularis* Dearness and Bartholomew n. sp., on leaves of *Solidago latifolia* L. at Komoka (Ontario), June 1913; 7) *S. lupincola* n. sp., on leaves of *Lupinus perennis* L., at Oakland, near London (Ontario), July 1915; 8) *S. sanguinea* n. sp., on *Ribes sanguineum* Pursh, in British Columbia, September 1912; 9) *S. Macrosporia* n. sp., on *Chrysanthemum Leucanthemum*, at London, October 1915; 10) *Leptostromella conigena* n. sp., on cones of *Picea Abies* (L.) Karst., at London, April 1915; 11) *Melanconium parvulum* Dearness and Bartholomew n. sp., on dead branches of *Betula populifolia* Marsh, along the south-eastern shores of Lake Huron (Ontario), May 1912.

Further mention is made of *Cylindrosporium Crataegi* Ellis and Ev. on leaves of *Crataegus brevispina* in British Columbia, September 1914; *C. Toxicodendri* (Curtis) Ellis and Ev. on living leaves of *Rhus Toxicodendron*, etc.; *Ramularia Lapsanae* (Desm.) Sacc., on *Lapsana communis* L. at Elgra (Ontario), July 1915, etc.

MEANS OF PREVENTION AND CONTROL

1031 - **Seed Sifting as a Means of Controlling Fungous Diseases.** — HENNING ERNE in *Kungl. Landtbruks-Akademiens Handlingar och Tidskrift*, 55th Year, No. 1, pp. 282-Stockholm, 1916.

According to ZIMMERMANN, the mycelia of certain parasitic fun may retain their vitality for five years in the seeds of grass plants. Th writer had satisfied himself a long time ago that the appearance of *Ustilag Tritici* was clearly related to the time and conditions of flowering. Whi it occurs very rarely on *Hordeum distichum erectum*, with close ear, which du ing the phase of fertilisation keeps its flowers entirely enclosed in the glume it is on the other hand very frequent in *H. distichum nutans*, with loose e and in which at the time of fertilisation the flowers at the tip and sometime those at the base of the inflorescence open. At that moment, the numerou spores of *Ustilago* carried by the wind penetrate the floral organs, grow an take up their abode in the mass of the grain. For loose-eared varieties o barley therefore it would be desirable to remove these infected grains at th time of sowing. A feature by which they may be distinguished is their siz The grains inserted at the tip and at the base of the inflorescence are distin guished by smaller bulk, and between the bulk of the grains and the per centage of infected plants, as the Author was able to prove by many experi ments, the following inverse ratio exists:

(*Ustilago nuda*).

ngth of grains in mm.	2.0	2.25	2.50	2.75	3.0
rcentage of infected plants . . .	3.2 %	4.6 %	1.9 %	1 %	0.1 %

The choice of bulky grains also allows of reducing the number of plants fested with *Helminthosporium gramineum*, as results from the following ta:

ngth of grains in mm	2.0	2.25	2.50	2.75	3.0
rcentage of infected plants	42.5 %	13.2 %	35.6 %	25.4 %	15.3 %

Experiments conducted at Ultuna have shown that oat plants grown m small seeds are more liable to attack by *Puccinia graminis*.

From the foregoing it follows that the sifting of seed may in many ses furnish a method calculated, not perhaps to get rid completely of the ms of certain diseases, but at any rate to diminish to a notable extent e percentage of infected plants.

32 - **Economic Data relating to the Treatment of Potatoes with Bordeaux Mixture against *Alternaria Solani*.** — See No. 1014 of this *Bulletin*.

33 - ***Diplodia Zeae*, the Cause of Dry Rot in Maize.** — VAN DER BIJL PAUL A., in *Union of South Africa, Department of Agriculture, Division of Botany and Plant Pathology, Science Bulletin* No. 7, pp. 1-63, Pl. 1-15. Pretoria, 1916. DISEASES OF VARIOUS CROPS

The disease known by the name of " dry rot " in maize is produced by e fungus *Diplodia Zeae* (Schw.) Lev., reported so far in Europe, America, stralia, and at various points in South Africa.

One of the most conspicuous symptoms of the disease is the appearance a dense growth of whitish mycelium, which develops in the furrows be- een the caryopses, makes its way to the centre of the bracts, surrounds filamentous stigmata and forces them against the internal face of the cts — which become discoloured, — and afterwards forms round the ear a ge dry envelope, formed by the hyphae of the fungus.

The caryopses of the diseased ears are stunted and light in weight, dark colour, and are easily detached. The colourless segmented hyphae, of readth of from 1.15 to 3.08 μ are not capable of perforating the cell parti- ns, but they generate into the interstices of the cells and vessels through areolae. The mycelium in itself is not distinguished from other fungi *usarium* spp.) parasitic on maize. On the other hand, a characteristic of genus *Diplodia* is the small black pycnidia which usually grow on the e of the alveolae, as may easily be seen on breaking the diseased ear es. They are however also found embedded in the mycelium on the ropses and bracts, and sometimes even in the culm, near the nodes or at oint corresponding to some lesion.

The shape and size of the pycnidia vary greatly : they may be pear- ped (from 187.5 to 337.5 μ), ellipsoid (150 × 330 μ), spherical or spheroidal m 200 to 275 μ). The wall of the pycnidium is formed of two layers ells, and on its internal face grow the hymenium and the spores, bilocular dly trilocular), straight or slightly curved, cylindrical, brownish-black

and of variable dimensions: 19.8 — 33 × 4.95 — 6.6 μ. The conidiophores are unicellular, colourless, with rich content of protoplasm and measure 6.16 — 10.75 × 1.54 — 1.55 μ. The spores are of low resistance power, and although they are able to pass through the alimentary canal of animals without undergoing apparent deterioration, their vitality is nevertheless greatly impaired; exposure to the sun delays their germination; the germination capacity dies out entirely in spores one year old. The writer has studied the growth of spores under anaerobic conditions, with various degrees of alkalinity and acidity, after exposing them for 2 hours to the action of freezing mixtures. In plain agar the fungus grows little. On the other hand, if a little oat flour is added to the agar a rich growth occurs. Among the fungicides examined the best results were obtained with lithium salts, which stop the growth of the mycelium and prevent the germination of the spores.

As means of control against dry rot it is advised: 1) to remove from the fields and destroy by fire all vegetable residue which, if left there, would become centres of infection; 2) to discontinue maize-growing for some years in the infected zones, and also in the adjoining fields.

As was stated above, the diseased caryopses are distinguished by their light weight which is brought out clearly by the following table:

	Weight of ear without bracts		Length of ear		Weight of caryopses		Weight of rachis	
	healthy	inoculated	healthy	inoculated	healthy	inoculated	healthy	inoculated
	g	g	cm	cm	g	g	g	g
1	252	154	19	18	210	96	42	56
2	294	252	19.5	23	224	162	84	70
3	224	196	18.5	18.5	168	154	70	42
4	238	182	19	19	196	140	84	42
5	238	196	18.5	17	182	140	56	56
6	322	252	20.5	21.5	252	196	70	56
7	392	294	23	22	308	224	84	70
8	336	210	21.5	23.5	266	196	56	42
Average per ear	287	217	19.687	20.312	225.75	163.5	66.25	54.25

The average loss of weight of the caryopses is therefore 27.8 %, and, in serious cases, it may even amount to 50 %.

The alteration of the grains is due largely to the action of a diastatic enzyme secreted by the mycelium of *Diplodia*, which attacks and destroys the embryo and the starch grains.

Another enzyme afterwards separates the fatty substances, which accounts for the reduction in the fat content in the infected maize. When fed to livestock the latter does not cause any poisoning but the deterioration in its composition really does not make it a food to be recommended.

934 - **Researches on the Silver-scurf Disease (*Spondylocladium atrovirens*) of the Potato** (1). — SCHULTZ S. EUGÈNE, in *Journal of Agricultural Research*, Vol. VI, No. 16, pp. 339-350. Pl. XLV-XLVIII. Washington, D. C., 1916.

The researches made in connection with the potato disease known as silver scurf", and caused by *Spondylocladium atrovirens* Harz., show that spite of the great differences in the size of the spores (which had led some riters to assume the existence of two different species, with macrospores d microspores), there really exists only a single species. This follows arly from the fact that by cultivation in pure lines (namely, from a single ore) conidia are obtained measuring from 18 to 64 μ. *S. atrovirens* exbits a negative heliotropism, which does not materially affect the develop-nt and appearance of the infection.

In agar cultures the conidia and mycelium withstand the most intense siccation without being affected. The thermal optimum lies between 21° d 27°, the maximum amounts to 30° C; as regards the minimum, growth ases at 2°-3° C, death only occurs at — 10° C.

Neutral or slightly acid media are thus apparently most adapted to ng about the growth of the fungus. The presence of 5 per cent of sac-rose in the agar prevents the formation of the spores.

The parasite enters the tubers through the lenticels, and its mycelium er-runs the epidermis and the more superficial layers of the bark, which breaks up, producing lesions of various kinds. The epithelium breaks ay in the form of silvery scales (" silver-scurf ") The nutritive value of e potatoes is not diminished, but their marketable value is very much preciated.

The infested potatoes readily carry the disease from one place to an-ner, and in the same locality they carry it over from one season to another; e mycelium, the conidia and sclerotia retain their vitality for a long time, d as soon as the degree of humidity and temperature allow, they grow and velop rapidly.

As active means of preventing the spread of the disease the following e advised: 1) treating the infected tubers with a hot solution of 1 % mer-ric chloride; 2) maintaining a very low temperature in the places of storage; discarding even slightly infected potatoes when sowing.

935 - **Tobacco Diseases and Pests in Eastern Java.** — See No. 967 of this *Bulletin*.

936 - ***Diplodia* sp., a Melon Disease in the United States.** — MEIER F. C., in *Journal of Agricultural Research*, Vol. VI, No. 4, pp. 149-152, Pl. XVII. Washington, D. C., 1915.

According to the facts reported in this preliminary notice, fruit deal-in the United States have in the past few years had heavy losses in con-uence of a disease attacking melons (*Citrullus vulgaris*) in railway trucks l sometimes destroying a large part of the goods or rendering them un-table before they reach their destination.

The first symptom of the disease is a slight discolouration of the rind, ch starts at the stalk and finally involves almost the entire surface of

(1) See also *B.* Sept. 1913, No. 1105 and *B.* Nov. 1914, No. 1071. (*Ed.*)

the fruit. The tissue of the rind then softens and shrinks, the pulp becoming black and gelatinous.

The writer was able to isolate and cultivate the pathogenic agent. It consists of a species as yet unidentified, belonging to the genus *Diplodia*; the diagnosis was confirmed by the entirely positive results of a series of artificial inoculations.

The fungus has separate or adjacent pycnidia, which may or may not be covered with a network of hyphae from 180 to 250 μ in diameter; the spores are oval, 24-30 × 10-14 μ, brownish-black and segmented. In the matter extracted from artificially inoculated melons the presence of paraphyses was not observed; the latter developed on cultivating the fungus on cylinders of potato.

In the United States the principal crops attacked by *Diplodia* are the sweet potato, *Citrus* fruits, maize and the cotton tree. As, in the South, cotton fields, sweet potato and melon fields are not separated from each other it was of interest from the economic point of view to ascertain whether a species of *Diplodia* found on the one host is capable of development on an other also. Experiments in this direction yielded positive results: a culture of *D. tubericola* E. et E., inoculated into healthy melons produced a series of symptoms identical with those described above.

1037 - ***Sclerotinia libertiana*, a Disease of Citrus and Other Plants Cultivated in California.** — SMITH O. CLAYTON, in *Phytopathology*, Vol. 6, No. 3, pp. 268-278. Fig. Baltimore, Md., 1916.

The citrus disease known under the name of "white mould" or "cottony rot" is very frequent in California, in storage places of citrus fruits during the period January to March. Besides the fruits of the lemon tree it also attacks the small branches of orange trees and lemon trees in the plantation, and likewise, but more rarely, the flowers of the lemon tree. The pathogenic agent is supposed to be *Sclerotinia Libertiana* Fuckel. The pathological changes observed on the fruits is characterised externally by an abundant white growth of mycelium of cottony appearance, and internally by a progressive softening which converts the tissues into a soft mass. The disease spreads rapidly, and all the lemons contained in one case are soon infested, and form a dangerous centre of infection in the store house. The bark of the small branches of the plants growing in the open air or under glass becomes ashy in colour and fibrous in consistency, and gum exudes plentifully all around the infected plant. *Scl. Libertiana* can likewise develop in the flowers, where excellent conditions are available in the thick mass of the petals at the beginning of flowering.

This fungus not only attacks *Citrus* spp. but also the flowers of the apricot, the small branches of the alligator pear tree (*Persea gratissima*), cucumber, tomatoes, vetches, lettuce, nettles, egg-plants, etc.

The practice prevailing in California of sowing vetches in citrus plantations must have contributed greatly to the spread of the disease.

It is also easy to produce artificial infection of the disease on lemons in a wet environment, by means of applications or inoculations of mycelium, sclerotia, spores or fragments of apothecia of the fungus. In this respect

results were always positive, even when substances of different source
d origin were used, isolated in several parts of the United States from the
ferent hosts of the parasite.

Cultures of lucerne affected with *Scl. Trifoliorum* also causes rotting
the fruits of the lemon tree, which, however, instead of turning straw yel-
as in the other cases, assumed a nut-brown colour.

As means of control it is advised to wash the citrus fruits with an 0.02
cent. solution of sulphate of copper.

- Black Rot of the Vine (*Guignardia Bidwellii*) Attacking *Vitis rotundifolia* and *V. Munsoniana* (Muscadine Grapes) in the United States of America. — See No. 987 of this *Bulletin*.

- *Hypoderma deformans* n. sp., Attacking the Leaves of *Pinus ponderosa* in the United States and Canada. — WEIR JAMES R., in *Journal of Agricultural Research*, Vol. VI, No. 8, pp. 277-288, Fig. 1-5, Pl. XXXII. Washington, D. C., 1916.

The writer describes as a new species, under the name of *Hypoderma deformans* n. sp., a fungus which attacks the leaves of *Pinus ponderosa* Laws. several parts of the United States and Canada : Montana, Oregon, Idaho, shington and British Columbia.

The black, glossy apothecia, 10 mm. in length and about 1 mm. in dth, may develop in the form of a continuous or broken band over the en- e length of the leaf; the asci are spindle-shaped, the spores olive green colour, transparent, slightly curved, with blunted tip, and have a septum reaching maturity ; the paraphyses are numerous and thread-like, slightly ollen at the tip.

The end of the infected leaves turns yellowish brown, and this change eads more or less rapidly throughout the leaf until the final appearance of apothecia. The exact length of time between the first symptoms of the ease and the ripening of the apothecia varies greatly, being sometimes ril-May to November ; it is occasionally prolonged until the following ing. The apothecia may contain asci in all stages of development, so as produce ripe spores continually. The period of most intense spore form- on, however, is found to be in May and June, when rains are frequent l when the plants have attained their maximum active growth. The leaves acked end by withering completely and falling, which causes many oubles and changes in the growth of the buds. One of the most conspicuous nomena consists of the appearance of very large "witch's brooms" a diameter of 1-2 yds and a weight exceeding one cwt. The formation these witch's brooms had been erroneously attributed to *Razoumoiskya mpylopoda* (Engelm.) Piper ("yellow-pine mistletoe"), but they are cer- inly connected with the presence of *Hypoderma deformans*. The bran- es thus deformed are generally sterile.

The disease not only attacks plants which have already attained a rtain growth, but also young nursery plants, causing the death of the lat- r when the attack is very severe.

WEEDS AND PARASITIC FLOWERING PLANTS

1040 - **"Witch Weed" or "Rooi-Bloem" (*Striga lutea*), a Phanerogam parasi on Maize in Rhodesia.** — WALTER J. A. T., in *The Rhodesia Agricultural Journ* Vol. XIII, No. 2, pp. 234-236. Salisbury, 1916.

The appearance of "witch weed" or "rooi bloem" (*Striga lutea*) h been reported in the valley of Mazoe; its occurrence is recognised by t scarlet colour of the inflorescence and the reduction in the foliage. attaches its roots to those of maize and deprives its host of a considerab quantity of sap, hindering its growth and sometimes preventing the form tion of the ear.

S. lutea spreads rapidly, and is capable of destroying within a short time throughout entire districts, the crop of maize, this being the only cultivate plant which is the host of the parasite. In consequence of this fact contr experiments were carried out by means of appropriate rotations, but th result of these trials was negative, owing to the persistence of the *Striga* seed which are capable of retaining their vitality for many years in the soil.

The only practical remedy is to pull up the *Striga* plants and destro them by fire as soon as they appear on the surface of the soil.

1041 - **Khaki Weed (*Alternanthera Achyrantha*) in Queensland.** — BAILEY J and WHITE C. T., in *Queensland Agricultural Journal*, New Series, Vol. V, 5th Par pp. 277-278, Fig. 1. Brisbane, 1916.

A description of the "Khaki weed" (*Alternanthera achyrantha* R Br.). It was imported from Argentina to Africa in forage during the Bo war. It was introduced into Australia, first invading New South Wale and afterwards extending to Queensland.

1042 - **Cut-leaved Nightshade (*Solanum triflorum* Nut.) and London Rocket (S *symbrium Irio*). New Weeds in New South Wales.** — HAMILTON A. A., in *cultural Gazette of New South Wales*, Vol. XXVII, 4th Part, pp. 275-276. Sydney, 1

"Cut-leaved nightshade" (*Solanum triflorum* Nut.) a solanaceous pla reported in the district of Cooma. The berries and overground parts the plant, which contain solanine, are poisonous.

"London Rocket" (*Sisymbrium Irio* L.) a crucifer met with in the env rons of Cobar and Nyngan. The plant was probably introduced wit lucerne seeds. It has no injurious properties, but in view of the rapidit and intensity with which it spreads in lucerne fields, replacing the cro *S. Irio* is regarded as a weed.

1043 - ***Agrostemma githago* among Cereal Grains: Determining the Coefficie of Impurity.** — See No. 968 of this *Bulletin*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

– Experiments in Locust Control by Means of *Coccobacillus acridiorum* in Argentina (1). — KRAUS RUDOLF, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 18-25, pp. 594-599. Jena, June 19, 1916.

The writer first gives a description of *Coccobacillus Acridiorum* dis-ered by FELIX D'HÉRELLE in Mexico in 1909. He then refers to the trol experiments conducted by D'HÉRELLE himself in Mexico, and finally mentions the observations made on this bacterium in Colombia, South ica and Argentina.

In Argentina, the Ministry of Agriculture has appointed a Commission, which the Author is a member, the object of which was to repeat the ex-iments of D'HÉRELLE and draw up a detailed report on the results ob-ned. The Commission had at its disposal cultures coming direct from Pasteur Institute and which, according to bacteriological investigations, responded perfectly to the *Coccobacillus* of D'HÉRELLE.

D'HÉRELLE described this *Coccobacillus* as a micro-organism having typical characters. For that reason the Author thought it necessary determine in the first place whether in the intestine of locusts there are micro-organisms resembling the *Coccobacillus* of D'HÉRELLE. He was able isolate from the intestine of the healthy insect organisms which are mor-logically identical with the *Coccobacillus*, which led him to suppose that latter is usually present the intestine of the locust.

For the purpose of successful control of locusts in the open field, a viru-culture is required, according to D'HÉRELLE, who says that before ning the experiment the virulence must be checked to see whether sufficiently effective. Unfortunately no criterion of virulence is indi d.

He only says that 12 passages through locusts are sufficient to give the ures the necessary virulence.

The virulence was determined by the writer by means of a normal loop. culture used first had a virulence of 1/200 loop, and later, after passing ugh the locusts, a virulence of 1/2000 loop. The virulence of this ure remains unchanged for a long time. The writer not only increased virulence of the *Coccobacillus* of D'HERELLE, but also found that the same t may be equally well obtained in relation to the micro-organisms iso-d from the intestine of locusts.

After checking the virulence the Author made experimental infection *Coccobacillus* in the laboratory, giving infected foods to the locusts. trary to the observations of other experimenters, he ascertained that e insects, even in captivity, will take fairly large quantities of food. The eriments, however, were negative in result, even when large rations of cted food were given.

(1) See also *B.*, April 1913, No. 750. (*Ed.*)

The writer next made experiments in the open field with young insects With this object he selected localities liable to invasion and distinguishe by good climate and abundant herbage. For the purposes of the experi ments the plots were surrounded by a zinc band, as is done for mechanica methods of control. The bacterial culture was spread over several plot containing young locusts, but without success. In no case was any endemi destruction of the insects observed in consequence of the treatment. Eve in one case where 200 insects afterwards placed on the plot were artificiall infected, the results obtained were negative.

The writer draws the following conclusions :

1) It is not possible to produce in the open field the epidemic infe tion and the death of young locusts by spraying with a culture of *Coccob cillus* the virulence of which has been increased by successive passage

2) It may thus be concluded that this *Coccobacillus* is a normal i habitant of the intestine of healthy locusts, and that it only kills the latt when injected into the abdominal cavity;

3) By administering this bacterium to young locusts with food, n infection is obtained.

1045 - ***Spicaria Cossus*** **n. sp., a Hyphomycete isolated from the Larva "Cossus Rongebois" (*Cossus Cossus*).** — PORTIER PAUL and SARTORY, in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXIX, No. 14, pp. 706-701, Pa Paris, July 22, 1916.

In nature, beneath the bark of various trees there are often found i the larval tunnels, mummified larvae of *Cossus cossus* (1) invaded by pinkish-white fungus resembling silkworm larvae which have died fro "muscardine".

On killing a larva of *Cossus* and keeping it under suitable condition of humidity, the same pinkish-white fungus is seen to develop in its tissue

The writers, who have made a study of this fungus on several spec mens of caterpillars taken wild or reared in captivity, describe it under t name of *Spicaria Cossus* n. sp.

1046 - **A Form of *Botrytis bassiana*, Isolated from the Larva of the Macrol pidopteron *Nonagria typhae*.** — PORTIER PAUL and SARTORY in *Comptes ren des séances de la Société de Biologie*, Vol. LXXIX, No. 14, pp. 702-703. Paris, July 1916.

The larva of *Nonagria typhae* lives inside the stalks of *Typha latifol* devouring the pith.

On killing one of these caterpillars and keeping it in a sufficiently moi place, it is seen to mummify and become covered with a whitish coatin made up of the fructifications of *Botrytis*.

From the morphological point of view, it is not possible to differentia the *Botrytis* on *Nonagria* from *B. Bassiana*; on the other hand, t different biological characters which the Authors have been able ascertain do not appear to them sufficient to constitute the *Botrytis* *Nonagria* a new species.

(1) See *B.* Jan. 1913, N° 88 and Jan. 1915, N° 131.

Ed.

17 – **The Successful Treatment with Insecticides of Plants in Flower.** — See No. 963 of this *Bulletin*.

18 – **Insect Pests of the Sugarcane in Queensland, Australia.** — JARVIS EDMUND, in *Queensland Bureau of Sugar Experiment Stations, Division of Entomology, Bulletin* No. 3, pp. 48, Pl. I-IV. Brisbane, 1916.

INSECTS INJURIOUS TO VARIOUS CROPS

List of insect pests of the sugar-cane in Queensland, accompanied by rticulars as to the nature and extent of the damage sustained and the bits and distribution of these insects.

1) The " noctnid moth borer " (*Phragmatiphila truncata* Walk. — fam. *loctuidae*), caused extensive injury to plantations in October 1914; the lar- e make their way into the young shoots and still tender buds, mine tunnels id partly destroy the tissues; they cause a rapid drying up of the foliage. atural enemies are : *Pheidole megacephala; Apanteles nonagriae* which kills e larvae, and *Euplectus howardi* which destroys a large number of pupae; Moth stalk borer (*Diatraea saccharalis* Fabr. — fam. *Crambidae*) : this sect, so greatly feared elsewhere, hardly causes any injury in Queensland, here climatic conditions and natural enemies impede its development; Beetle borer (*Rhabdocnemis obscurus* Boisd. — fam. *Curculionidae*), has tablished itself in the district of Johnstone River, where it destroys some ousands of tons of cane every year; for control, a tachinid fly, which is its tural enemy, was recently introduced into the region, namely, *Ceromasia henophori* Vil., discovered in New Guinea and already tried with success the Fiji Islands ; 4) Moth shoot-borer (*Polyocha* sp. — fam. *Pyralidae*), hich is rather rare ; the writer met with it in November at Pyramid, here it attacked the young shoots in the same way as *Phragmatiphila* ; *Opogona glycyphaga* Meyr. (fam. *Tineidae*) occasionally attacks the seed ds and sometimes destroys up to 80 % of the buds ; also gnaws the leaf eaths and the bark, and at times makes its way inside the cane and tunnels walls ; 6) *Loxostoma* sp. (fam. *Tineidae*) and *Cosmopterix* sp. (fam. *Elachi- idae*) are unimportant ; 7) Black gauger (*Heteronychus* sp., fam. *Scara- eidae*); set eater (*Pentodon australis* Blackb. - sub-fam. *Dynastides*) id white ant (*Termes meridionalis* — fam. *Termitidae*), only occasionally jure the sugar cane, which they gnaw, and attack the newly opened ds and young plants ; 8) Wireworm (*Monocrepidius* sp., fam. *Elateridae*) riously attacked new seedlings on the alluvial plains of Mackay and in me other localities of the district of Isis in 1910 ; 9) Yellow winged locust *acusta danica* Linn., fam. *Acridiidae*) invaded the western and northern rovinces of Queensland in 1912 in huge swarms ; they devoured the leaves the plantations and partly destroyed the crop ; among their natural ene- ies there are noted *Scelio australis* and *S. ovi* parasitic on the eggs;) Large mottled locust (*L. australis* Brunner) is, like the last-named species, ommon in the coast region of Queensland and New South Wales ; 11) Long- osed locust (*Atractomorpha crenaticeps* Blanch.) ; short-horned locust (*Oxya lox* Fab.); *Cyrtacanthacris* (?) *proxima* Walk.; *C. plagiata* Walk.; *C. guttu- a* Walk., all belonging to the family Acridiidae ; these insects occur in e cane plantations of Queensland, but so far have not occasioned any great mage ; 12) Army worm (*Cirphis unipuncta* Haw., fam. *Noctuidae*), wrought

great havoc in 1912 in the districts of Cairns and Mossman ; 13) Skipper butterfly (*Paruara mathias* Fab., fam. *Hesperidae*), the larvae of which were seen gnawing the leaves of the canes at Harvey's Creek in December 1914 ; 14) *Telicota augias kreffti* Macl. (fam. *Hesperidae*) and *Padraona marnas* Feld. (fam. *Hesperidae*), the larvae of which were sometimes observed in the plantations at Babinda ; 15) Grass worm (*Chusaris rhodias* Turner, fam. *Noctuidae*) attacked leaves at Gordonvale on the 2nd September 1914 ; 16) Web worm (*Harmologa miserana* Walk. (?), fam. *Tortricidae*), at Pyramid, towards the end of October 1914, was observed on the rhizomes of the cane ; 17) Browntail moth (*Euproctis holoxutha* Turner, fam. *Liparidae*), occasionally attacks the foliage ; 18) Plant eating beetle (*Rhyparida morosa* Jac., fam. *Chrysomelidae*); its usual host is assumed to be blady-grass (*Imperata arundinacea*), which, however, is disappearing little by little owing to the extension of cultivation ; the insect, thus forced to seek its food alsewhere, began to attack the sugar cane ; the savanna and heath fires, usually ignited every year, effectively help to prevent excessive development and spread of this parasite ; 19) *Colasposoma sellatum* Baly, *Rhyparida didyma* Fab. (fam. *Chrysomelidae*) and the leaf eating weevil (*Stenocorynus aridus* Pasc. fam. *Curculionidae*) are rather rare and economically unimportant ; 20) *Aphis sacchari* Zehn., *A. adusta* Zehn. (fam. *Aphididae*), *Tetigonia pantheon* n. sp. Kirk (fam. *Tetigoniidae*), *Perkinsiella saccharicida* Kirk. (fam. *Asiracidae*), *Aleurodes berghi* Sign., snow fly (fam. *Aleuridae*), *Ripersia* sp. (fam. *Coccidae*) and *Pseudococcus (calceolariae* Mask ?) (fam. *Coccidae*) cause more or less damage to plants, of which they suck the leaves ; 21) *Lepidiota albohirta* Waterh., *L. frenchi* Blackb., *L. rothei* Blackb., *L. caudata* Blackb., *L. froggatti* Macl. (fam. *Melolonthidae*); *Dasygnathus australis dejeani* Macl., *Xylotrupes australicus* Thomp., *Isodon puncticollis* Macl. (fam. *Dynastidae*) *Cacachroa decorticata* Macl. (fam. *Cetoniidae*); *Anoplognatus boisduvali* Boisd. (fam. *Anoplognatidae*) and *Anomala australasiae* Blackb. (fam. *Rutellidae*) attacks the roots of the cane ; the most formidable among these latter insects is undoubtedly *Lepidiota albohirta*. To control it light traps are used and also arsenical compounds with some success.

1049 - ***Nysius vinitor*, a Hemipterous Pest in Australia.** — Froggat W. W., in *Agricultural Gazette of New South Wales*, Vol. XXVII, 4th Part, pp. 270-272. Sydney, 1916.

The Rutherglen bug (*Nysius vinitor* Berg) which appeared in dense clouds throughout the territory of New South Wales, South Australia and the State of Victoria, has caused much injury there to orchards, seed plots and even garden flowers (1915-1916).

The presence of this insect in a potato and tomato field is immediately revealed by the fall and yellowing of the leaves, and rapid destruction of the fruits. Peaches and apricots are attacked in all stages of growth and spoilt by the numerous holes which *Nysius* opens in the skin in order to draw out the pulp juices.

The following means of control are advised : 1) destroying by fire the grass prairies amid which the insect lays its eggs, and from which the first migrating columns which invade cultivated lands start ; 2) applying an infusion of tobacco and soap ; when the insect is in the early stages of deve

pment good results may be obtained ; 3) using kerosene torches against lults ; a bundle of branches fixed to the end of a rod is dipped in kerosene id lit ; by rapidly moving the flame round and among the plants the insects e immediately killed, but care and some skill are required to carry out is operation without burning the leaves or the fruits ; 4) resort may be d to the use of light traps ; good results were obtained with them in sever- localities, but the method however is too expensive and complicated become a customary practice on a farm.

50 - **Unspotted Tentiform Apple Leaf Miner (*Ornix geminatella*), a Micro-lepidopterous Pest of several Fruit Rosaceae in America.** — HASEMAN L., in *Journal of Agricultural Research*, Vol. VI, No. 8, pp. 289-295, Pl. XXXIII. Washington, D. C., 1916.

Ornix geminatella Pack. has been extremely abundant in Missouri of e years, and has attracted the attention of fruit growers throughout the ite. The insect lays its eggs on the leaves of several Rosaceae, and the vae hatched from them bore tunnels in the thickness of the leaves, damag- them to a lesser or greater extent.

Among the hosts of *Ornix* the writer enumerates the following : apple e, crab-apple (*Malus* sp.), *Crataegus* spp., *Prunus* spp., *Pyrus* spp.

As regards its distribution, *O. geminatella* has been reported in the fol- ing localities : New England, New York, Ithaca, (N. Y.), Illinois, Colorado, ntucky, Michigan, Massachusetts, Connecticut, Ohio, etc.

The natural enemies of this microlepidopteron are recorded so far as: *mpiesis nigrifemora* Ash., *S. tischerae* Ash., *S. meteori* Girault, *Eulophus eaticoxa* Girault, *S. dolichogaster* Ash., *S. minutus* Howard and *S. litho- lletidis* Howard.

51 - **Woolly Pear Aphis (*Eriosoma pyricola* n. sp.), Injurious to the Pear Tree in California.** — BAKER A. C. and DAVIDSON W. M., in *Journal of Agricultural Research*, Vol VI, No. 10, pp. 351-360, Fig. 1. Washington, D. C., 1916.

The writers describe as a new species, under the name of *Eriosoma pyri- la* an aphis hitherto believed to be *E. lanigerum* Hausmann (= *Schizo- ura lanigera* Hartig) or " woolly apple-aphis ". This new species attacks e root system of all kinds of pear trees in California, and particularly in- es the French wild pear tree so commonly employed as stock, especially the Bartlett varieties. The Kieffer, and above all the Japanese types, on e other hand, are highly resistant. The wingless form of this aphis usually es on the fibrous radicles, down to a depth of a yard in the ground, and e colonies are generally more numerous in the vicinity of the trunk, al- ough frequently met with even at 3 or 4 yards' distance. This *Eriosoma* es not confine itself to attacking the young roots, but also, though more ely, attacks the completely formed roots, and sometimes even the main ots. In this latter case, however, it is localised in the hardened tissues veloping in consequence of an abrasion. Colonies of this aphis can even e on the underground part of tender and swollen shoots. It is not like *E. igerum*, which produces tuberous excrescences and lesions on the largest ots of the apple tree ; it prefers the rootlets, and destroys them without using the appearance of any special hypertrophy. Adult trees have little

to fear in the attack of *E. pyricola*, and only in extreme cases can the latte prevent or slightly retard their growth. The case is quite different wher it is a question of young plants less than 4 years old. The almost simul taneous loss of a large number of rootlets may completely arrest growth an bring about a premature fall of the leaves, frequently followed by the deat of the plant.

Winged forms appear in autumn. In gardens and in all localities wher the environmental conditions are favourable to the growth of the winge individuals, the outbreaks in spring and at the beginning of summer are al ways unimportant, in view of the small number of wingless individual which hibernate on the roots, while the major part of the colony migrate From the month of July onwards, however, the aphids increase rapidly attaining their maximum number in September, at which time the winge forms appear. The departure of the winged swarms, which often migrat even to great distances, also marks a period of rest for the plant, which now having nothing to fear but the few wingless aphids remaining on the root through winter, puts forth new rootlets and gathers strength to resist fres attacks.

The winged forms stay on the leaves and trunk of the pear trees, an afterwards generally take up their abode on the foliage and trunk of *Alnus* sp., where they go through their life cycle and produce the sexual generation

1032 - ***Galerucella cavicollis*, a Coleóptерous Pest of Cherry and Peach Tree in the United States** (1).—CUSHMANN R. A. and ISELY DAYGHT, in *United States Depart ment of Agriculture, Bulletin* No. 352, pp. 1-28, Fig. 1-9, Pl. I-IV. Washington, D. C., 1916

In the spring of 1915, the cherry and peach plantations extending over a vast area in the north-east of the United States sustained considerable damage from a sudden and formidable outbreak of *Galerucella cavicollis* Le Conte (cherry-leaf beetle). This already known beetle had never previously caused such extensive injury. Among the regions which suffered most are the States of New York and Pennsylvania and the northern part of Western Virginia.

The adults attack the leaves of the cherry and peach and the fruits of the cherry, gnawing them and producing fairly deep injuries. When the attack is very severe, the plants may be almost completely stripped of leaves. The natural host of *Galerucella* is said to be *Prunus pensylvanica* (bird cherry) which spreads with great rapidity along the road sides in the thickets and on the lands formerly occupied by forests destroyed by fire, which form a very favourable environment for the growth and multiplication of the insect. The latter hibernates in the adult form, leaving its shelter in the spring; it mates and the female oviposits at the foot of the trees amid the dried leaves and other vegetable detritus. The larvae hatch in a fortnight, and when full grown, pupate in a hole which they have made in the soil. The adults emerge in two or three weeks and spread through the plantations where they attack the leaves and fruits. This continues

(1) See *B.* June 1916, No. 718.

roughout the good season until the first colds compel them to seek elter.

Among the natural enemies of *Galerucella* mention must be made of e coleopteron *Lebia ornata* Say, which attacks the adults, tears off the ytra and feeds on the soft tissues. It also kills the pupae and feeds on iem, only leaving the pupal skin intact.

For control there are advised: 1) applications of 40 % solutions of nitine sulphate, in the proportion of one part to 600 of water; the addition soap (1 part per 200 of mixture) increases the efficacy; 2) applications sweetened lead arsenate, especially for cherry trees, according to the folwing formula: 1.3 lb. lead arsenate, 0.33 galls of treacle and 11 galls of ater.

33 - **Terrapin Scale (*Eulecanium nigrofasciatum*), Injurious to the Peach Tree in America.** — Smanton F. I., in *United States Department of Agriculture, Bureau of Entomology, Bulletin* No. 351, pp. 1-96, Fig. 20. Washington, D. C., 1916.

Eulecanium nigrofasciatum Pergande causes more and more serious jury to peach trees in the eastern States and especially in Pennsylvania d Maryland. From here it has spread to the north where it attacks other ants, among which *Acer pseudoplatanus* L. and *A. saccharinum* L. are favourite hosts. Towards the south-west, it has already reached the lf States and has attacked *Phoradendron* spp., on which it thrives well. ie range of this *Eulecanium* tends to increase in such measure that it on will probably be spread in all the regions where the peach, the plum, er spp. (maple) and *Phoradendron* spp. occur in abundance.

Host plants are: the sycamore maple (*Acer pseudoplatanus* L.); silr maple (*A. saccharinum* L.); sugar maple or rock maple (*A. saccharum* .); *Amygdalus Persica* L. and its varieties; spice-bush (*Benzoin aestivale* .) Nees); *Betula* spp.; saffron plum (*Bouncia angustifolia* Nutt.); *Canea dentata* (Marsh.) Borkh.; red-bud (*Cercis canadensis* L.); Japan quince haenomeles japonica* Lindl.); *Clematis* sp.; hawthorn (*Crataegus Oxycan-* L.); *Crataegus* spp.; quince (*Cydonia oblonga* Mill.); oleaster (*Elaeagnus ngustifolia* L.); "wahoo" or "burning bush" (*Evonymus atropurpureus* acq.); *Fraxinus* sp.; American holly or white holly (*Ilex opaca* Ait.); weet bay (*Magnolia virginiana* L.); wild China tree (*Melia Azedarach* L.); forus sp.; *Nerium Oleander* L.; *Olea* sp.; wild cherry (*Padus* sp.); mistlee (*Phoradendron* spp.); sycamore or plane-tree (*Platanus occidentalis* .); European plane-tree (*P. orientalis*); cottonwood (*Populus deltoides* larsh.); Simon plum or apricot plum (*Prunus Simoni* Carr.); *Prunus* spp.; yrus communis L.; *P. Malus* (L.) Britton; live oak (*Quercus virginiana* fill.); *Ribes* spp.; *Rosa* spp.; weeping willow (*Salix babylonica* L.); *Sa-* spp.; soapberry (*Sapindus marginatus* Willd.; *Tilia* spp.; *Vaccinium* pp.; *Vitis vinifera* L.; and *Vitis* spp.

Of the numerous cultivated host plants, the peach tree has suffered ost up to now. *Eulecanium* causes two-fold injury: 1) it abstracts the p, and thus in course of time weakens the leaves and impairs their functions; it deposits honey-dew on the leaves and fruits, which are rendered use-

less both owing to this fact and to the abundant growth of fungi, which find an excellent medium in this honey-dew.

The natural enemies of *Eulecanium* may be divided into two groups: *a*) the predatory enemies, which prey on the young stages or adult insects; *b*) parasites.

Among the predatory enemies are: lace-wing fly (*Chrysopa nigricornis* Burm.); *Hemerobius stigmaterus* Fitch.; *Laetilia coccidivora* Comst.; *Camptobrochis nebulosus* Uhl,; and *Hyperaspis binotata* Say.

Among the parasites are *Coccophagus ater* How.; *C. cognatus* How.; *C. lecanii* Fitch.; *c. cinguliventris* Gir.; *C. longifasciatus* How.; *C. flavoscutellum* Ashm; *C. fraternus* How.; *Aphycus annulipes* Ash.; *A johnsoni* How.: *A. stomachosus* Gir.; *Anagyrus nubilipennis* Gir.; *Eunotus lividus* Ashm; *Pachyneuron altiscuta* How.; *Prospalta auxantii* How.; *Chiloneurus albicornis* How.; *Blastothrix sericea* Dalm. and *Comys fusca* How.

As artificial means of control, it is advised to apply: 1) in the spring before the buds open, the following mixture:

Raw linseed oil	5 gallons.
Gasoline	3 "
Soap	2 pounds
Water	92 gallons

2) after the trees are in full foliage, and before the *Eulecanium* migrates leafward, apply the following:

Flour (in paste)	10 pounds
Stone Lime	15 "
Sulphur	20 "
Water to make	50 gallons

1054 - ***Anastrepha serpentina*, a Dipteron Injurious to Several Fruit Plants in Brazil** (1). — DA COSTA LIMA A., in *Boletim do Ministerio de Agricultura, Industria e Commercio*, Year IV, No. 3, pp. 99-104. 1 Pl. Rio de Janeiro, 1916.

In Brazil, *Anastrepha serpentina* Wied ("mosca de frutas") injures the fruit of the following plants: *Mammea americana* L. ("abricoteiro do Pará"); *Lucuma Caimito* A. D. C. ("abieiro"), *Mimusops coriacea* Miq. ("abricoteiro") and *Sapota achras* Mill. ("sapoteiro").

The female bores a hole in the pericarp and deposits its eggs therein as many as twenty at a time; the larvae, which hatch within 3 or 4 days, feed on the pulp, in which they tunnel, often causing the fall of the fruit.

Means of control: 1) gathering and destroying the damaged fruit; 2) spraying with sweetened arsenical solutions (for instance: raw sugar, 2 lbs.; lead arsenate 3 oz.; water, 4 galls.); the applications must be made every 15 days; 3) vessels containing poisoned attractive substances (for instance sugared water and arsenic salts), which are suspended to the branches of the fruit plants attacked.

1055 - **Gravepine Flea Beetle (*Haltica chalybea*), a Coleopterous Pest of *Vitis rotundifolia* and *V. Munsoniana* (Muscadine grapes) in the United States of America.** — See No. 987 of this *Bulletin*.

(1) See *B.*, April 1915, No. 451.

INJURIOUS VERTEBRATES.

6 - **The Control of Field Voles in Italy.** — SPLENDORE ALFONSO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Serie 5, Vol. XXV, 2nd Half Year, Part I, pp. 46-49. Rome, July 1916.

In Capitanata (province of Foggia) and the adjoining provinces (1) ich have been invaded by field voles, the Italian Government has *inter* appointed a Committee instructed to take such measures as may best adapted to combat this scourge.

Technical experts have been sent to the region over-run, both in order study the effects on the spot and to undertake control measures by all sible means. Ditches have been excavated and traps used to prevent at any rate limit the spread of the field voles from the fields to the vine-rds. Different poisoned baits have been put down, and different kinds virus have also been used.

The ditches and traps proved effective, but insufficient to achieve the rpose in view of the extent of the infested parts and the considerable mber of the rodents.

Among the poison used, zinc phosphide alone proved efficacious (2).

The different viruses gave negative results undoubtedly owing to loss their virulence.

It is well known that the viruses which have been recognised as suita- for field vole control are Löffler's bacillus and Danysz's bacillus (3). They y be transmitted to field voles either by subcutaneous injections through the digestive passages, but the drawback is that the cultures ily lose their virulence. The Ministry of Agriculture therefore instructed e writer to undertake investigations with the object of producing a new us of sufficient activity for the case in question; the investigations were ried out partly in Capitanata and partly in the Laboratory of Agric-ural Entomology of the Royal University of Rome.

In field voles (*Pytymys savii*) captured at Cerignola, the writer observed e constant presence of a micrococcus, both in the circulating blood and the various internal organs, and the lymphatic glands in different parts the body. In some of these rodents, for which a microscopic examination the internal organs had given negative or almost negative results, the germ is found in large quantities in the lymphatic glands of the axillae. The cro-organism is readily stained with aniline dye and Gram's stain. In the sues, where it occurs both within and without the cells, it often has the coc-orm and even diplococcal appearance; in artificial cultures (agar and ord-ry bouillon) it retains this appearance for some time; later on it takes a more and more bacillary aspect, and occurs likewise in short and thick-

(1) See *B.* August 1916, No. 921. (*Ed.*)

(2) See *B.* January 1914, No. 89.

(3) See *B.* Jan. 1911, No. 362; *B.* June 1911, No. 2016; *B.* Oct. 1912, No. 1488; *B.* Nov. 2, N. 1567; *B.* July 1913, No. 897; *B.* Jan. 1915, No. 132. (*Ed.*)

set forms sometimes polar staining with aniline dyes. At Cerignola the writer found this micro-organism both in dead and dying voles, and even in some living animals more or less healthy in appearance. Certain it is that the presence of the micrococcus is accompanied by a high mortality. On the other hand, in the field voles captured and examined at Foggia the writer did not find either any infection produced by the above germ or epidemic disease.

The writer advises scattering the dead field voles collected in the principal centre of the infection (region of Contessa near Cerignola) through the other regions over-run by these rodents, but where infection in these latter has not yet taken place.

The writer is continuing his enquiries in order to ascertain: whether the virus can be communicated by means of ectoparasites (fleas and especially lice); whether the micro-organism observed by him is more or less analogous to that of Löffler and Danysz; whether it is utilisable in field vole control and in what way.

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